THE

ELECTRICAL REVIEW.

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THE

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1900

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THE NATIONAL PHYSICAL LABORATORY.

THE establishment of the new National Physical Laboratory does not seem to make the rapid progress one would like to see. It is very desirable that great care and attention should be given to the questions of the site, of the character of the buildings, and of the organisation of the staff, before the work is begun, and it would be unwise to press Mr. Glazebrook and his Council to make their decisions before they see their way clearly. At the same time it is difficult to understand why so much delay is occurring. The project of the laboratory has been in the minds of the men who have induced the Government to take it up for a number of years, and an outline programme of the work to be undertaken must have been in existence for a long time. The character of the buildings required is roughly determined by the nature of the work to be done in them, and by the amount of the Government grant, and we understand that the Committee has taken evidence on their form and general design. The experience already gained at Charlottenburg and Sèvres in the organisation of similar institutions should facilitate a decision of the arrangements of the new one. It now appears that no site has yet been secured. The Council, after consideration of several alternatives, have made up their minds that the Old Deer Park, at Richmond, is the most suitable place, and we gather that terms have been arranged with the Commissioners of Woods and Forests for an annual tenancy of 15 acres of that Park. But the arrangement is not completed, and a strong protest has been made by the inhabitants of Richmond and Kew against the alienation of so large a space of public ground in a place so valuable to Londoners. The *Times* of July 6th gave a report of an interview with the Treasury of a deputation from the Council of the Physical Laboratory, to meet the objections raised to the occupation of the Richmond site. To the objection that the area to be taken is excessive, it was replied that there is no intention of occupying more than a very small part, and that the rest would be left open to the public, the Laboratory Council only desiring to obtain such control over it as will enable them to prevent any interference with their work. To the objection that a large area would be covered with buildings, it was replied that only one-quarter of an acre would be built over, and the suggestion that the operations to be conducted would cause public annoyance was met by the obvious reply that noise or disturbance of any kind would be fatal to the work of the laboratory, which would be the very last place in the world where anything of the kind would originate. We have no doubt that the grievance of the inhabitants of Richmond is, on the whole, imaginary, and has been put forward in ignorance of the real character of the scheme. To this extent the Council seem to be responsible for the trouble, since they could probably have conciliated the local opposition by giving precise information about their plans. The

amount of space which will actually be lost to the public use will be very small, and the presence of an institution, such as the National Laboratory, especially if its exterior is ornamental or imposing, adds a great deal of interest to a park. The inhabitants of Greenwich would be very sorry to exchange the Observatory for the right of walking in what is now the Astronomer Royal's garden. There is not much probability, however, that we shall see a group of buildings at Richmond of such singular interest as those on Greenwich Hill. It is doubtful whether the Council will prove in the long run to be wise in placing the laboratory so near London. The question before them probably resolved itself into the relative inconveniences of being far from London, and near to electric railways. The convenience of being close to London is a known quantity, and is certainly great; the extent of the interference of stray earth currents with the future work of the laboratory is quite unknown, and may prove to be very small. We believe they have decided rightly, because they are evidently themselves alive to the possibilities of trouble. The ultimate result may be that the magnetic work will go into the country; but neither would this be a matter of much moment, nor is there any occasion to anticipate it. We hope it is very explicitly understood, however, that if the Council are allowed to put their laboratory near London, they must not be allowed to object to any railway extensions in the neighbourhood on the ground of interference with it. Locomotion in London is so important that we should be unwise to allow new vested interests to be created which could interfere with its development.

Incandescent Lamps.

THE important question of raising the general efficiency of the electric incandescent lamp is receiving the attention it deserves in America, while manufacturers and supply companies in England do not appear, as yet, to have realised the advantages that would be gained by intelligent co-operation. In the present state of things the consumer only appreciates long life in his lamps. Whether or not they are consuming an abnormal amount of power compared with the candle-power emitted he is unable to judge. If the lamps obtained from A burn out quickly he will buy lamps from B, and if B's lamps last longer, the consumer is satisfied that he has overcome his difficulty. If he finds his electric light bill larger than before the introduction of B's lamps, he puts it down to an exceptional number of foggy or dark days, or to the company's meter being wrong. It would never occur to him that a short-lived lamp could possibly be more economical than a long-lived one. This possibility is, however, fully appreciated by electrical engineers, and the system whereby the electric light company undertake the supply and renewal of lamps *free* is rapidly extending in the United States. It is found that owing to the deep-rooted idea that long life means economy in lamps, consumers will buy the lamp that lasts longest. Now at the present low price of lamps the cost of energy consumed during its life is many times the cost of the lamp, and when the charge for current is at a contract rate based upon the number of lamps installed, it is easily seen that the average efficiency of the lamps on the consumers' premises will have a very important influence upon the amount of energy the supply company will have to generate under their contract. Under the present system in England, where current is paid for by meter, the supply company argues that it is the consumers' business to get economical lamps, and that the more watts consumed by the lamps per candle, the better pleased the company will be. But this attitude is only consistent with the view that an electric lamp is a power-consuming device, and this reveals a want of appreciation of the function of the lamp, and of the growing necessity of popularising the electric light in the estimation of the general public. We could, with advantage, take a leaf out of our American cousin's book of experience, and by taking the onus of selection and purchase of lamps off the shoulders of the consumer, the supply companies would ensure a satisfactory light to the consumer, and probably increase the earning capacity of their plant by 20 to 25 per cent., and enable the manufacturer to give more attention to the lamps he turns out, while reducing the cost of production.

Cheap Electric Power.

THE rational attitude of the *Times* toward the several electric power schemes which have recently occupied so much attention, has been, we doubt not, of considerable service to the electrical industry of this country in influencing Parliamentary minds during the past few months. In a summary of the recent events in connection with the schemes and their progress in Parliament, and before Committees, that journal on Monday last gave the main considerations in an excellent manner. It is hardly to be expected that municipal authorities who have been having things so much their own way in electrical matters will rest contented with the decisions which have been announced by the Committees. In fact, once more they are proposing to endeavour to defeat the Bills in the House of Commons. Their chances of success are discussed by the *Times* as follows:—

> As a matter of tactics, if once we accept the idea that the interests of British trade are of no moment besides the *amour propre* of Corporation officials, the Association are, doubtless, wise in opposing. They have no fewer than three different chances of gaining. They may possibly defeat the Bills, or some of them, outright. Or, secondly, they may force the promoters to make large concessions to secure the withdrawal of opposition. Or, thirdly, and, perhaps, this is their chief hope, they may so delay the passage of the Bills through the House of Commons, that the House of Lords will be unable to pass them before the prorogation, for sheer lack of time.

The article closes:—

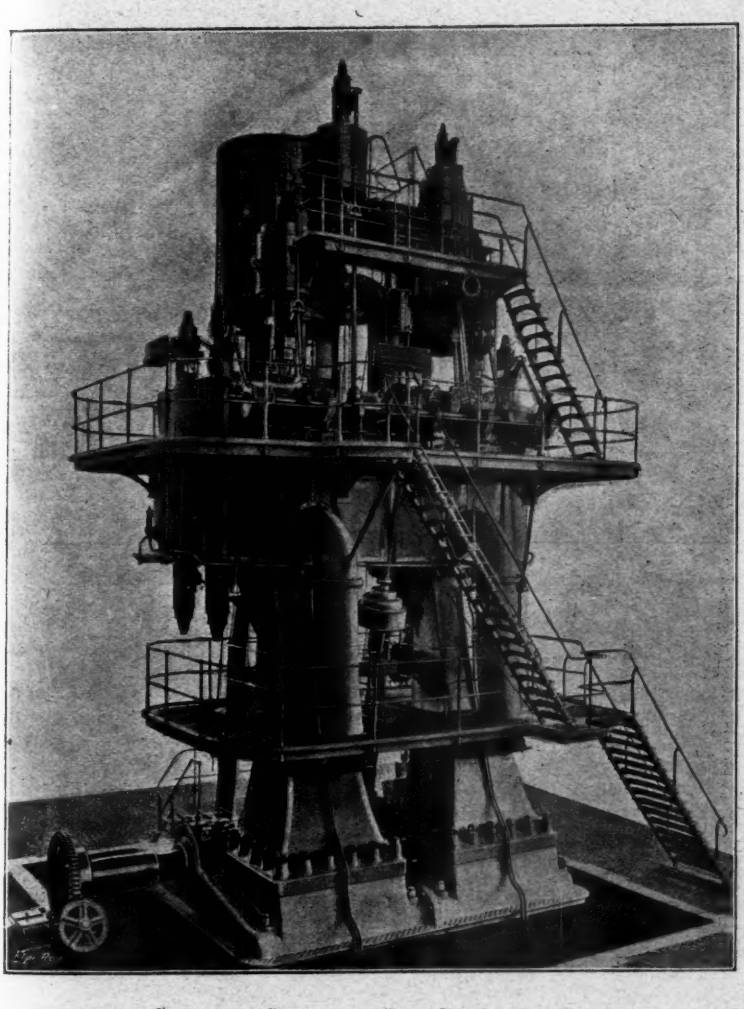
> It is, of course, arguable that further protection on individual points is required either for the trading interests of particular corporations or by the public at large. But the Bills have to go before a committee of the House of Lords in the ordinary course, and now that the main issues are decided and the case is reduced to manageable compass these points can easily be raised and a decision obtained. But the nine weeks' discussion before Sir James Kitson's committee has made it abundantly clear that there is great and urgent need for provision of cheap electricity in wholesale quantities, if England is to hold her own in the industrial competition of the world, and that such provision cannot in the nature of things be made by municipalities, still less by urban and rural district councils. In the circumstances the action of the Association of Municipal Corporations, a body of public servants, bound to consider not their own individual interests, but the interest of the public, in endeavouring to secure the entire rejection of these Bills, seems difficult to justify. Were the Association by chance to be successful, members of the House of Commons would have little encouragement to imitate in future Sessions the public-spirited and self-sacrificing care and assiduity which Sir James Kitson's committee, day after day for many weeks in succession, devoted to the Electric Power Bills of the Session of 1900.

OPPOSITION TO ELECTRICAL UNDERTAKINGS.

[FROM A LEGAL CORRESPONDENT.]

THE numerous private Bills which have been brought before Parliament in the present session relating to electrical undertakings throughout the country have nearly all been opposed, more or less strenuously, by the promoters of rival undertakings. Electricity, as a means of distributing light and power, is a formidable competitor to steam and gas, and it is not unnatural that its progress should be watched with some jealousy by those whose interests are bound up with other means of locomotion and illumination. Opposition, however, has not, either in this or in previous years, been confined to railway and gas companies. The local authority may wish to reserve (in so far as it is necessary to do so) the right to supply electricity, or to lay down a plant in opposition to that of some private company, and must needs claim the right to be heard; or an electrical supply company already established by sanction of Parliament may, not unnaturally, seek to oppose the inauguration of a competing system.

Consequently the time of the Private Bill Committees is frequently occupied in hearing counsel in opposition to fresh schemes for the application of electricity. That such opposition is likely to be fruitless becomes apparent when we read the opinion expressed by Sir James Kitson, as chairman, and with the sanction of the committee to which electric lighting and power Bills have been referred in the present Session of Parliament. He said:—"The value of electrical energy as a means for the transmission and application of power has been amply demonstrated, and its importance to the industries of this country is admitted. The committee accordingly advise that it is of public advantage to facilitate measures which may ensure a general supply of electrical power to all consumers who may seek to avail themselves of the economy and efficiency offered in the service of these sources of application of power."



GENERATING SETS AT THE PARIS EXHIBITION.—FIG. 1.

Although opponents to schemes for electrical development are not in future likely to be regarded with great favour, it is quite clear that they are in many cases entitled to be heard, and in the light of experience afforded by the records of private Bill legislation during the last few years, their opposition is not always vain. The district in question may be found to be sufficiently well served by existing companies: or for some other sufficiently cogent reason the committee may refuse to allow the preamble of the Bill. In view of the existence of this undoubted right to be heard in opposition, it is interesting to consider the extent of the right and the nature of the interests of the various persons who may appear before a Parliamentary Committee in opposition to a scheme for electrical development.

The question whether a company or person has a right to be heard, or in other words, whether there is any *locus standi*, usually arises, and is finally determined before the private Bill is argued before the Select Committee. Otherwise, on the appearance of an opponent before the Select Committee, the promoters might object that he had no *locus standi* to so appear; whereupon his cost of bringing witnesses, and so forth, would have been unnecessarily incurred.

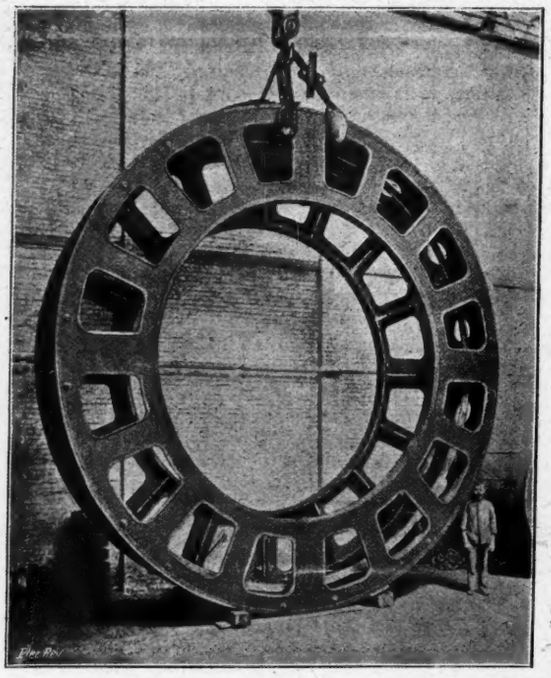
The various matters which are taken into consideration in deciding who is entitled to oppose an electric lighting or power Bill will now be discussed. References are made to cases reported in the *locus standi* reports, which are issued from time to time. These reports contain a short and concise statement of the facts of each case, but differ from the more familiar law reports in this important respect, namely, that there is no reason given for any of the decisions. Hence it remains for the text-book writers and lawyers to deduce the underlying principles from a multitude of single instances. It is also important to remark that the grant of *locus standi* involves nothing more than leave to be heard: the opponents may well be found to put forward no valid objection to the Bill when it comes on to be heard in Committee.

The right of a landowner to appear in opposition to any Bill which involves the compulsory purchase of his property, or any part thereof, is too well known to demand more than a passing comment. Other questions arise, however, when the proposed works are not in or upon, but near to his premises.

Where proximity to works proposed by a Bill is not in itself a ground for obtaining a *locus standi*, an owner or occupier of land in such proximity, none of whose land is proposed to be compulsorily taken, if he is given a *locus standi* is given only a *limited locus standi* as opposed to the general *locus standi* to which one whose land is proposed to be taken compulsorily would be entitled. It is limited generally to such portions of the Bill as affects some special interest of his which appears entitled to be protected. The above proposition may be illustrated by saying that the mere diminution in value which will be caused to an estate, none of which is taken by the making of a railway near it gives no right of *locus standi* to the owner or occupier, but the obstruc-

tion or partial destruction of a right of access to business or other premises, where it is a serious and substantial injury to the premises has been considered a sufficient ground for allowing a *locus standi* to the owners and occupiers of such premises against the portion of the Bill relating thereto.

In nearly all cases, however, where the petitioners against a Bill can show that the object of it is to enable promoters to construct works or to authorise undertakings which will compete with those of the petitioners, they are allowed a *locus standi*. So in the case of the Aberystwith and Welsh Coast Railway (Steamboat) Bill, 1865, which was a Bill to authorise the railway company to provide and use steamboats in the transmission of traffic between certain ports in Wales



Generating Sets at the Paris Exhibition.—Fig.

and any ports in Ireland which they might think fit, the Steamship Owners' Association of London, petitioned against the Bill, alleging that they represented parties who were owners of steamships and other vessels engaged in carrying on communication between England and Ireland, and that the powers sought by the Bill, if allowed to pass, would authorise the company to injuriously compete with the petitioners. The *locus standi* was allowed, although it was not stated in the petition that the petitioners used any of the specified ports in Wales.

It has been held to be a good ground of objection to the *locus standi* of a petitioner who petitions on the ground of competition against a Bill authorising any works, that such petitioner is not legally entitled to carry on the undertaking, competition with which shall be objected to. Thus in the case of the Tyldesley-cum-Shakerley Local Board Gas Bill, 1865, which was a Bill to enable the Tyldesley-cum-Shakerley Local Board to supply gas to various districts, including among others a considerable portion of the township of Atherton, the Bill was opposed by the Atherton Gas Company, who had made arrangements with the Atherton Local Board to light the streets and public places of Atherton with gas. It turned out, however, that the company had no legal right to enter into such arrangement, having no Parliamentary powers to break up streets, and on this ground their *locus standi* was refused.

With regard to opposition by ratepayers the Committee will generally require the persons appearing in opposition to be representative of the ratepayers before admitting their *locus standi*. Thus in the Ystradyfodwg (Maerdy) Order [1899, 1 S. & A. 312] a projected Bill confirmed a provisional order authorising the promoters, an electric lighting company, to supply electricity to the district within which the petitioners were ratepayers and owners of property. The petitioners alleged that they were injuriously affected, and claimed a *locus standi* under S. O. 134, and further contended that they were entitled to be heard as consumers of gas. The promoters contended that the petitioners were not entitled to be heard as they did not either in numbers or rateable value represent the owners and ratepayers of the district, that the local authority of the district who had the right to oppose had consented to the Bill, and that as consumers of gas the petitioners were not a sufficiently representative body to entitle them to appear. The *locus standi* was disallowed, on the ground that the petitioners did not adequately represent the inhabitants.

(To be continued.)

GENERATING SETS IN THE GERMAN SECTION OF THE PARIS EXHIBITION.

There are four large generating sets in the German section of the Paris Exhibition. Three of the engines are vertical, two by the Nurnberg Engine Company, and the other by

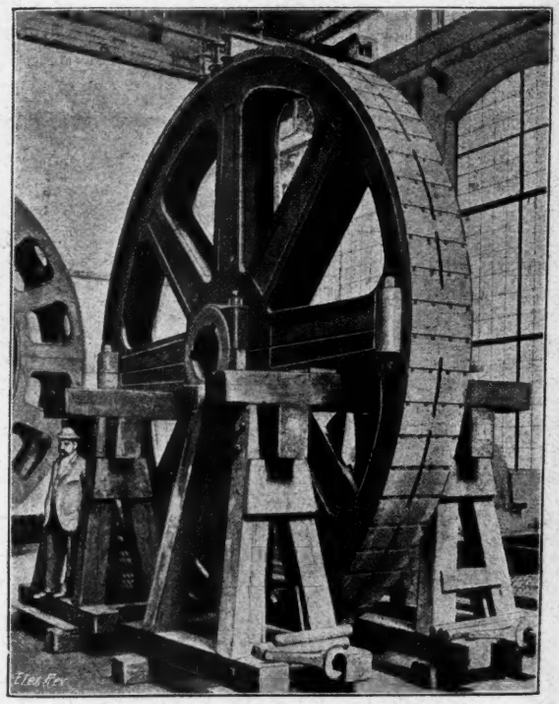


Fig. 3.

A. Borsig, of Tegel, Berlin. The fourth engine is of the horizontal type, and is by the Augsburg Engine Company (which, by the way, is amalgamated with the Nurnberg Company).

Borsig Engine, Siemens & Halske Alternator.

Fig. 1 shows the Borsig four-cylinder triple expansion engine, which has been built to give 2,500 H.P. at 90 revolutions per minute, with steam at 210 lbs. pressure, and condensing.

The following are the leading particulars:—

Diameter of high pressure cylinder ...			760 mm.
„	intermediate	„ ...	1,180 „
„	low pressure	„ ...	1,340 „
Length of stroke ...	...	...	1,200 „

Two cranks at 180°.

Bedplate in two parts, each weighing 29 tons.

Weight of fly-wheel, 41 tons.

Ramsbottom packing rings for high pressure cylinder.

Buckley packing rings for the intermediate and low pressure cylinders.

The valves are all of the double seat type, provided with Coltmann's oil cataract.

For the high pressure and intermediate pressure cylinders one eccentric actuates both the admission and the corresponding exhaust valve.

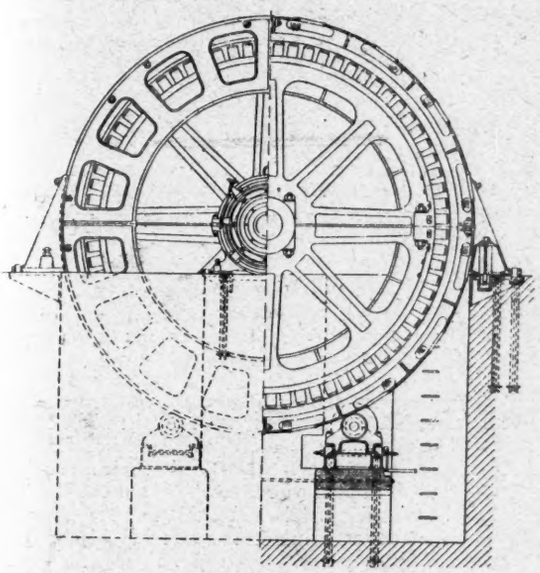


Fig. 4.

The air pumps have piston and cover valves, but no suction valves. The pistons are worked through a beam from a disc and connecting rod on the end of engine crankshaft.

This engine has three platforms, which are necessary, because of the excessive height.

The Siemens & Halske three-phase alternator is illustrated in figs. 2, 3, 4 and 5, which show the armature ring, the fly-wheel, and the details of armature ring support and pole-pieces respectively.

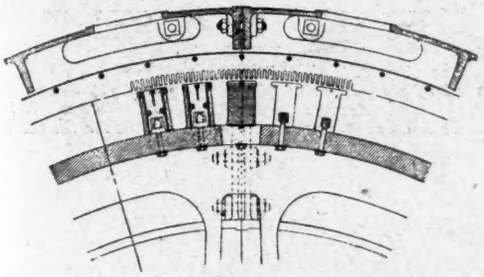


Fig. 5.

The following are the leading particulars of the machine :—

Output, 2,000 kw. at 2,000—2,200 volts, 50 periods, winding of field of copper strip 4 × 23 mm. on edge, 40 turns per pole, and total weight 4 tons.

Resistance of field coils 1 ohm, and excitation 28,000 to 42,500 watts at 210 volts.

Armature core of stampings 0·5 mm. thick; 648 slots each, 13 × 55 mm.

Armature copper 7 × 44 mm. cross-section, there being one conductor per slot. Total weight of copper 2½ tons, and resistance 0·057 ohm.

The exciter has an output of 45 kw. at 210 volts. The armature is mounted direct on the alternator shaft, and is without an outside bearing.

CURRENT SPECIFICATIONS.

XXI.—SOUTHEND-ON-SEA AND DISTRICT LIGHT RAILWAYS.

Summary.

Extent of Contract.—The present contract consists of five separate sections :—

Section A.—Boilers, fittings, and boiler house accessories.
Section B.—Steam generators, travelling crane, switchboards, &c.
Section C.—Tramway and lighting feeders and distributors.
Section D.—Overhead equipment.
Section E.—Trucks and car equipments.

Number and Size of Boilers.—Three, each to be capable of evaporating 6,000 lbs. of water per hour, to be either of Davey-Paxman's "Economic," Babcock & Wilcox "Water-tube," or Lancashire type.

Size of Fuel Economiser.—Messrs. Green's type of not less than 192 tube size.

Type of Condenser.—Surface type capable of dealing with 15,000 lbs. of steam per hour, and maintaining a 26-inch vacuum.

Size of Feed Water Heater.—To be capable of dealing with 2,000 gallons of water per hour.

Size of Cooling Tower.—To be of Wheeler-Barnard type, and capable of dealing with 1,500 gallons of water per hour.

Size of Steam Dynamos.—Three to be supplied, two of 200 kw. capacity, and one of 100 kw.

Specified Speed.—Speed of 100 kw. set not to exceed 360 revolutions per minute, and of the 200 kw. set, if the engine is fitted Corliss gear, 110 revolutions per minute; if with other valve gear, 180 revolutions per minute.

Type of Engines.—To be either of horizontal or vertical cross-compound type.

Type of Dynamos.—Multipolar, with a divided field frame, over-compounded to give 500 volts at no load and 550 volts at no oad.

Permissible Temperature Rise.—63° F. after 12 hours' run at full load. Machines to run for two hours at 50 per cent. overload without temperature rise exceeding 90° F.

Travelling Crane.—To be suitable for 41 feet span, and capable of lifting 20 tons.

Type of Switchboard.—Instruments on each panel clearly specified.

Cables.—Type proposed to be stated in tender, lengths scheduled, alternative offer for solid system or stoneware conduits invited.

Overhead Equipment.—7½ miles to be equipped, approximate number of poles specified; map of route may be inspected on application. Double trolley wire No. 000 B. & S. gauge to be used throughout.

Type of Truck.—To be either "Peckham" or "Brill." Four of maximum traction type, 12 ordinary type.

Type of Motors.—Specified to be of the General Electric Company of America's manufacture.

Type of Controllers.—Ditto.

Specified Dates of Completion.—Boilers, March 1st, 1901; steam dynamos, April 1st, 1901; cable work, to be stated in tender; overhead equipment, February 15th, 1901; trucks and car equipments, April 7th, 1901.

Penalty for Late Completion.—£2 per cent. per week on whole contract.

Stipulations as to Removal of Foreman.—See comments below.

Stipulations as to Wages paid to Workmen.—None.

Arbitration Clause.—Unsatisfactory—see notes below.

Date for Receipt of Tenders.—July 25th, 1900.

This specification has been prepared by the borough engineer, Mr. Alfred Fidler, A.M.I.C.E., and in several respects it bears internal evidence which makes us think that the compiler has not had an extended experience in the drafting of such documents. In many cases not only *the ends to be attained*, but also *the means to be adopted* are specifically stated. Thus, if water-tube boilers are tendered for, they are to be of Babcock & Wilcox make; the condenser, feed water heater, and cooling tower are to be of the Wheeler Company's make; the trucks are to be either of the "Brill" or "Peckham" type; and the motors and controllers must be of the General Electric Company of America's make.

In cases like this, the issue of a specification becomes almost superfluous; there can be no real competition, its compiler abdicates his proper function as *a consulting engineer*, and the contractor is either the firm specified or a middleman acting as a go-between on a small commission.

We must again enter our protest against this course of action. The Corporation, in a case like this, may adopt one of two courses; either privately arrange a contract with the firms whose manufactures they have selected, or let the contract go to competition in the usual manner, *i.e.*, issue a specification in which the results to be reached are clearly stated, but in which the actual types of the plant to be used are left to the selection of the contractor.

We trust our readers will clearly understand our position in this matter; it is not one of opposition to the employment of the local engineer as the consulting engineer when important engineering works or extensions are undertaken by his employers; we know of many cases in which most effective service has been rendered in this way, and often the engineer responsible for the after working of a plant knows better than anyone else what is required. When, however, such an engineer prepares a specification, which, as in this case, is issued for public competition, he acts as a consulting engineer, and as such ought to exercise the functions inseparable from such a position, viz., the *statement* of ends to be attained, from the offers make the *selection* of the methods to be employed, and the *supervision* of the carrying out of the work by the selected contractor.

The prevailing note in the general conditions is the submission of the contractor to the will of the borough engineer.

We have clauses like the following:—

Should any dispute, difference, or misunderstanding arise as to quality or amount of materials or workmanship, or as to the amount from time to time due or payable to the contractor, *or as to the true interpretation of any clause in these conditions or the specification, or as to any matter arising thereupon, or the plans or drawings, any such dispute, difference, or misunderstanding shall be referred to the borough engineer, whose decision thereon shall be binding and conclusive on all parties and without appeal.*

and:—

The borough engineer shall have full power to dismiss or discharge from the work any man or men for incompetence or misconduct, and the contractor shall not re-engage such men without the authority and consent of the borough engineer.

The borough engineer shall be at liberty, when he deems it desirable, to order the suspension of the works for any length of time which may, in his judgment, be necessary for the purpose or advantage of the execution of the works, and the contractor shall be bound so to suspend the work, and to resume the same when required by the borough engineer, but not before, without making any charge whatever on account of suspension, but the period of time during which the works may be so suspended shall be allowed to the contractor in computing the time of completion of the contract.

as well as others equally stringent. Against the first of these a strong protest should be made by every tenderer.

We have had occasion in several cases lately to call attention to the absence of arbitration clauses in electrical engineering specifications. It is noticeable that this complaint is not made in the case of the most prominent members of the consulting profession. They usually insert most satisfactory clauses permitting a contractor to ask for arbitration on any dispute in regard to the contract. Here, however, nothing of the kind is allowed, the borough engineer is not only one of the parties interested in any possible dispute, but also sole judge from whose decision there is to be "no appeal." The position of party counsel and sole judge at the same time is an impossible one, it is not fair on the part of the Corporation to place any of its officers in such a false position, and we feel sure that as soon as this is pointed out to them they will modify their attitude. In any case we strongly urge all tenderers to insist upon the inclusion in the final contract of an arbitration clause, at least as comprehensive as the one mutually agreed upon between the Municipal Electrical Association and the Electrical Plant Manufacturers' Association, which reads as follows:—

In case any dispute or difference shall arise between the purchaser, or his engineer on his behalf, and the contractor, either during the progress of the works, or after the determination, abandonment, or breach of the contract, as to the construction of the contract, or as to the reasonableness of any extra charge, or as to the withholding by the engineer of any certificate to which the contractor may claim to be entitled, then either party may within 72 hours, but not later give to the other notice in writing of the existence of such dispute or difference, and such dispute or difference may be referred to arbitration, which arbitration shall be deemed to be a submission to arbitration, within the meaning of the Arbitration Act, 1889.

The clause relating to dismissal of workmen is in its present form too drastic. It ought to read that the engineer has power to object for due reasons to the employment of any person on the works, and that the contractor shall, on the receipt of such objection, remove him, and not again employ him on this particular work. The actual dismissal must be done by the employer, not by the engineer.

The last of the three clauses given above, might be used in a very arbitrary manner. The contractor may have his different contracts so planned out that an unknown and indefinite suspension of one may so disarrange his plans that it will take far more than an exact equivalent in time at another period to complete the work. What is fair and right in such a case should be decided by an independent arbitrator.

The clauses dealing with penalties, both as to late completion, and non-fulfilment of the terms of the contract read as follows:—

The whole of the works shall be completely finished before the dates mentioned in the specification, and if the same be not completed as aforesaid, on or before the dates mentioned, the contractor shall be liable to pay, and shall forfeit and pay to the Corporation, *the sum of £2 per cent. per week on the whole contract*, as and for ascertained and liquidated damages, and not by way of penalty for every week which may elapse between the said 7th day of April and the actual time of completion of the works, and the sums so forfeited shall be deducted from the next or any payment to the contractor so far as the same shall extend; but any delay occasioned by unusual severity of weather, general strike of workmen, or any circumstances (other than lack of money) over which the contractor has no control, shall be allowed for by such extension of time being granted to the contractor as the borough engineer shall deem proper, and shall specify under his hand at the time of his making such allowance.

In case the terms of the contract be not duly performed by the contractor, the contractor shall pay to the Corporation a penalty of £1,000 without prejudice, and in addition to the liability of himself or his sureties upon any bond or security given or to be given to the Corporation for the performance by the contractor of the terms of this contract.

The sum of *£2* per cent. per week on the whole contract sum for late completion is excessive. At the conference on the subject of fair clauses for insertion in electrical engineering contracts, held between representatives of the Municipal Electrical Association and the Electrical Plant Manufacturers' Association, it was agreed that in no case was this percentage to exceed *one per cent. per week*, and the sums of *half of one per cent. per week* and *two and a half per cent. per calendar month* were held to be ample for the due protection of the purchaser. In sending in offers tenderers ought to limit their risks at least to the maximum amount then stated.

Under the general conditions given in the tender, with its refusal of any appeal against the decision of the engineer, agreement to a fine of £1,000 in addition to his personal liability and the liability of his sureties, if the terms of the specification are "not duly performed," is not to be recommended. Such a clause is not general in electrical engineering specifications, in operation it might prove very unjust, and in any case it should be assessed by an independent authority.

OUR LEGAL QUERY COLUMN.

[*Questions addressed to the Editors for insertion in this column should be as brief and concise as possible. Free use of fictitious names, &c., may be made. Answers are furnished by a duly qualified lawyer, but the Editors cannot undertake to be responsible for the accuracy of the views which he may express.*]

J. H. writes: "Several electric lighting companies and municipal works refuse to make a second test of a consumer's installation unless a fee is first paid. Under what clause of the Electric Lighting Acts or Provisional Order are they authorised to make these regulations and others relating to the wiring of houses?"

*** In answer to this query it is sufficient in the first place to refer to Section 40 of the Electric Lighting (Clauses) Act, 1899. It is there provided that an electric inspector, if and when required to do so by any consumer, shall on payment by the consumer of the prescribed fee, test the variation of electric pressure at the consumer's terminals, or make such other inspection and testing of the service lines, apparatus, and works of the undertakers upon the consumer's premises as may be necessary for the purpose of determining whether the undertakers have complied with the provisions of the special order and the Board of Trade Regulations. This seems to show that the electric inspector is entitled to demand a fee even on the first occasion. We are not aware of any section in any of the electric lighting Acts which renders it incumbent on the undertakers to test electric installations at the mere request of, and free of expense to, a consumer.

If our correspondent will refer to the Electric Lighting Act, 1882, Sec. 6 (45 & 46 Vic., cap. 56), he will find that undertakers are thereby vested with plenary powers as to the making of rules for the safe and efficient supply of electric current. Moreover, by R. 36 of the Board of Trade Regulations, 1890, undertakers are made responsible for all electric lines, fittings, and apparatus *belonging to*

them, or under their control which may be upon a consumer's premises being maintained in a safe condition and in all respects fit for supplying energy.

Save as aforesaid, we are not able to point to any sections which in terms authorise the undertakers to make regulations as to the wiring of houses.

Contractor writes:—"I should be pleased to have answers to the following questions through the medium of your Legal Query Column.

"(1) If a person erects for himself a large building, but sublets portions of it, say shops, facing a public road, can he supply the persons occupying his shops with the electric light, and charge for it? Mains are being laid in the town for the distribution of electrical energy, but the Corporation do not intend to pass the premises referred to for some time, perhaps years.

"(2) Is a corporation or company compelled to lay mains in particular places if required by a number of consumers?"

*** With regard to the first question put by "Contractor," there can be no possible objection to his supplying persons occupying his shops with electric light and charging a reasonable price for the same. As was pointed out in the Legal Query Column in our issue of June 22nd, the powers conferred upon the Board of Trade with regard to electric lighting installations are *enabling* only, so that it would not even be necessary for "Contractor" to obtain the leave of the Board to lay down his proposed installation.

With regard to the second question, a corporation or company provided with a provisional order is undoubtedly compelled to supply electricity, under certain conditions, to all consumers within its area of supply. The statutory provisions relating to this matter are contained in Sections 21—30 of the Electric Lighting Clauses Act, 1899. Thus by Section 21 the undertakers are bound within a period of two years after the commencement of the special order to lay down suitable and sufficient distributing mains for the purposes of general supply throughout every street or part of a street specified in that behalf in the special order, and shall thereafter maintain those mains. Section 24, however, answers the point put by "Contractor." By that Section the undertakers must obey any requisition requiring the undertakers to lay down distributing mains for the purpose of general supply throughout any street or part of a street, made by six or more owners or occupiers of premises along that street or part of a street. [A nice question might here arise as to whether the occupiers of "flats" in one building are "owners or occupiers of premises in the street" within the meaning of this section, but as this point is not raised we express no opinion upon it.]

PARLIAMENTARY COMMITTEES.

Baker Street and Waterloo Railway.

The Earl of Rosse presided on Tuesday last week at the House of Lords Select Committee for the purpose of considering the Bill to enable the Baker Street and Waterloo Railway Company to extend their already authorised underground line between Waterloo and the terminus of the Great Central Railway Station at Marylebone, by additions at each end, one to the Elephant and Castle, and the other to Paddington Station. Electricity is to be the motive power to be used, and a generating station is to be erected on the ground of the Indigent Blind School, near the Elephant and Castle. Capital power to the extent of £1,000,000, with the usual borrowing power of one-third as much, is sought. The scheme is opposed by the Metropolitan Railway Company, who contend that the line will unfairly compete with a section of their line between Baker Street and Praed Street, and that the manner in which the scheme is being financed is unsatisfactory.

Mr. W. R. Galbraith, C.E., for the promoters, stated that before 1896 the Baker Street railway had made no public attempt to obtain capital from anyone, because in the case of two similar lines appeals had been made and failed. An agreement had been entered into with the London and Globe Finance Corporation under which they were to construct the line and to receive the whole of the capital including the borrowing powers. The London and Globe Corporation entered into a contract with Messrs. Perry to construct the line for £877,000. That did not include the £50,000 which was to be handed to the Baker Street company for working expenses by the Globe Corporation, nor interest during construction or anything for land. Those things would have to be met out of the difference between £877,000 and £1,766,000, the amount of the shares and debentures. After all the charges were met, there would appear to be a paper profit to the Globe Company of £152,000.

Sir Wm. Pollitt, general manager of the Great Central Railway, gave evidence as to the value of the proposed extension at Paddington to the public, as did also Mr. J. Loftus Wilkinson, general manager of the Great Western Railway, and Mr. C. J. Owens, general manager of the London and South Western Railway, and further evidence having been heard, the promoters' case was closed.

At the sitting on Wednesday, Mr. Bell, managing director of the Metropolitan Railway, opposed the proposed extension from the terminus of the Great Central to Paddington, as it would run parallel to the Metropolitan line, and would, he said, injure its vested rights.

Sir J. Wolfe Barry gave evidence in support of Mr. Bell's contention, and

Mr. Freeman, Q.C., submitted, on behalf of the Metropolitan Railway Company, that the public really did not require the proposed extension, and seeing the competition it would cause, there was no justification for the scheme.

Mr. Page, Q.C., in the course of his reply for the promoters, and after urging that the scheme was quite a different one to that which Parliament rejected last year, said that it had at the back a strong financial corporation pledged to the extent of £500,000 to carry out the undertaking.

The preamble of the Bill was then agreed to by the Committee.

North Metropolitan Electric Power Supply Bill.

The Select Committee of the House of Commons, under Mr. H. H. Browne, met again on Friday, but gave no decision in the above Bill. As we reported a fortnight ago in the Electrical Review, the preamble of the Bill—which seeks to supply electricity in bulk over a large area in Middlesex, Herts and Essex, including Harrow, Hornsey, Chingford, Cheshunt, St. Albans and other places—were passed, but the consideration of the clauses were adjourned till Sir James Kitson's Committee had concluded the consideration of the group of electric power Bills referred to it, so that there might be uniformity of decision.

Last week the Committee again sat and considered the clauses which were settled on the same lines as those of the other power Bills.

Mersey Railway.

The Mersey Railway Bill came before the Chairman of Ways and Means as an unopposed measure. By the Bill the company is authorised to substitute electricity for the present mode of traction. The Bill was reported for third reading.

Halifax Tramways.

The Select Committee of the House of Lords, presided over by Viscount Portman, considered on Thursday and Friday last week the Bill of the Halifax Corporation, which dealt with the extension of boundaries, the construction of tramways, &c. There was no opposition to the tramway part of the Bill.

Bradford Tramways.

On Thursday last week the Bradford Corporation Bill came before Lord Morley's Committee of the House of Lords as an unopposed measure. The Bill, amongst other things, authorises the Corporation to construct additional tramways in and near the city. The Bill was ordered to be reported for third reading.

London United Tramways.

Before a Select Committee of the House of Lords on Wednesday, July 11th, under the presidency of the Earl of Rosse, the London United Tramways Company's Bill, the object of which is to considerably extend the tramway system in both Middlesex and Surrey, came on for consideration.

Mr. Balfour Browne, Q.C., who appeared for the promoters, gave particulars respecting the company's present tramways, and said they had constructed, or were authorised to construct, about 22 miles of lines from Hammersmith to Hounslow, and from Kew to Hanwell. By the Bill it was proposed to add over 17 miles of line, which would be from Acton to Hanwell, to complete the line from Shepherd's Bush to Uxbridge, an extension from Hounslow to Baker Bridge from the London Road, near Kew, and from Richmond to Twickenham, Hampton, Hampton Wick and Teddington. Practically the whole of the system, except one small piece in Richmond Road, was unopposed. At the present time the system was worked by horse traction, but electric traction was coming into vogue, and the promoters proposed to use it, and intended to construct a large generating station in the Chiswick Road for the purpose. Before long, 10 miles of the system would be worked by electricity, and it was intended soon to work the whole of the tramways by that system. A scheme had been promoted by the company before the Light Railway Commissioners, and every local authority in the district was in favour of it. Just before the thing was agreed to there was opposition from the London and South-Western Railway on the ground that the tramway would compete with their system, and a clause had to be inserted to meet that petition. The Middlesex County Council also, he was sorry to say, had petitioned against the Bill, although they were very slightly affected, but they aimed at becoming the purchasing authority in regard to tramways. Although that body made certain allegations which he altogether repudiated, he asked the Committee to give the Council only a limited *locus*.

Mr. Norton Smith, representing Heston, Isleworth and Ealing District Councils, protested against the Middlesex County Council's attitude, and asked that the charge of that body should be publicly withdrawn.

Mr. Allen, representing Twickenham, and Mr. Hutchinson, made applications in a similar sense, after which the Committee proposed the consideration and adjourned.

At the sitting of the Committee on Thursday, July 12th, the charge of the Middlesex County Council that there had been

improper payments by the promoters was gone into. The allegation was that payments had been made to the clerks of certain District Councils and others.

Lord Robert Cecil, Q.C., representing the Middlesex County Council, said the charges referred to Teddington. A sum of £70 1s. 8d. was paid by the company to the clerk in respect of costs, and there was also a payment of 200 guineas to the clerk in respect of a light railway promoted the previous year, which, however, was practically the same scheme as that now before the Committee.

After going into the matter, the Chairman stated that the matter did not affect the Bill, and it must be fought out in a proper Court. They declined to allow the clerks of the Teddington and Twickenham Councils to be called to refute the charges.

Further evidence was then given in support of the Bill, including that of Mr. Clifton Robinson, the managing director and engineer to the promoters. He stated that the proposed generating station at Chiswick would cover about 3 acres of land, and would cost about £150,000. The overhead trolley system was proposed, and the people in the district were favourable to it. When the lines were finished, a passenger could go from Hammersmith to Uxbridge, or from Hammersmith to Hampton Court in splendidly-equipped cars, which would cost £1,000 each. The Board of Trade would settle any dispute as to the mode of traction, and also as to the speed run.

On Friday local evidence was called in favour of the Bill, and the promoters' case closed.

Mr. Earle, representing the Middlesex County Council, then addressed the Committee, and urged that the payments proposed to be made by the tramway company to the local authorities should be expended in the upkeep of the roads, and further contended that roads in certain places ought to be widened.

Mr. Fitzgerald explained that payments to be made to the local authorities were in consideration of their agreeing that 24 years should be the term of the tramways company in respect to the whole of the tramways.

Evidence was then given by frontagers objecting to the scheme, and Mr. C. A. Brereton, C.E., contended that the proposed line was not suitable owing to the abruptness of the curves and its circular route.

The consideration of this scheme was resumed on Monday.

Mr. Wheeler addressed the Committee for the frontagers of Richmond Road, and contended that the overhead system was altogether objectionable. But there was nothing definite about the trolley system, for there were now many schemes afloat for motors. He, therefore, asked that the experiment should not be allowed. With regard to the consents of the local authorities, he submitted that they did not represent public opinion, but were gained by the company offering to spend large sums of money on road improvements.

After consulting in private for some time, the Chairman announced that the Committee found the preamble proved, and ordered the Bill to proceed.

Mr. Worsley Taylor, for the promoters, suggested that as the County Council had several long clauses which he thought they would be able to agree upon after discussion, they had better adjourn for a time.

This was agreed upon, and later in the day the Committee met and settled the clauses.

Metropolitan District Railway.

The Select Committee of the House of Lords, presided over by Viscount Portman, commenced on Friday the consideration of the Bill of the Metropolitan District Railway Company. The petitioners against the Bill were the West London Railway, the West London Extension Railway, and the Chelsea Electric Supply Company, whose opposition was directed against the electrical portions of the Bill.

Mr. S. Pope, Q.C., who represented the promoters, explained the efforts which the company had made to substitute an adequate system of electric traction for the present steam traction. As the result of the investigation and experiments of Sir J. Wolfe Barry and Sir W. H. Preece, a considerable amount of success had been obtained, and experimental trains were now running. While the company had power to apply electric energy, they had no power to erect a generating station, and powers were now asked for to purchase a site for that purpose at Chelsea Creek. Two cables were proposed for the carrying of the electric energy. One, by arrangement with the local authorities, would go underground, and the other it was proposed to carry on the extreme edge of the opposing company's land. Steps would be taken to prevent any electrical disturbance.

Sir J. Wolfe Barry was called, and stated that £20,000 had been placed at his disposal to experiment with electric traction, but so far no full-sized trains had been so worked. The proposed site for the generating station was a most suitable one. It was proposed to convey the electric energy by conductors placed in cast-iron boxes, 15 inches by 9 inches, placed 2 feet below the surface. The electrical equipment was estimated to cost £500,000.

Sir W. H. Preece, late electrician to the Post Office, gave evidence as to the experiments which had been made to work the trains of the company by electricity, the result being that larger and heavier trains had been so driven than ever before. His experience led him to believe that it would be unsafe to trust to one cable, hence the alternative route; with regard to which, however, they were prepared to give the opposing companies ample protection.

On Monday Viscount Portman's Committee resumed the consideration of the Bill.

Some evidence having been given in opposition to the Bill,

Sir J. Wolfe Barry again went into the witness-box and stated the objections there were to placing the generating station at Putney. Putney would not be so central as Chelsea Creek.

The Committee decided to pass the preamble, and ordered the Bill to be reported after adjusting the clauses.

Glasgow District Tramways.

On Thursday last week, the Court of Referees of the House of Commons, under the chairmanship of Mr. Parker Smith, considered various questions of *locus standi* arising in connection with the Glasgow District Tramways Bill.

It was explained by Mr. Pembroke Stephens that the Bill was one promoted by Mr. Murphy and others for the construction of two groups of electrical tramways. One group was in and around Paisley, and the other in and around Renfrew. Several of the petitions were withdrawn, but those remaining to which the promoters objected, were those of the Glasgow and Renfrew District Railway Company, and the Paisley and Barrhead District Railway Company.

Mr Pollock, Q.C., for the Glasgow and Renfrew District Railway Company, stated that this railway was now in course of construction for the purpose of meeting the local wants of Renfrew, and as the proposed electric tramway was in opposition to it, he claimed the right to be heard. The proposed tramway was intended to be a fully equipped electric system which would carry not only passengers, but also parcels.

Mr. Ram, representing the Paisley and Barrhead District Railway, also claimed a *locus standi* on the ground of competition.

Mr. Pembroke Stephens contended that the competition of the tramways would not be great enough to justify the Court granting a *locus standi* to the petitioners. The promoters had already reduced their parcel limit from 500 lbs. to 56 lbs., so as to do away with the opposition of the railway companies.

It was agreed to give the Paisley and Barrhead Company a *locus* on certain works' clauses and on the clauses authorising the construction of one of the tramways in the parish of Paisley on the Greenock Road. It was also agreed to give the Paisley and Barrhead Railway a competitive *locus* with regard to three tramways in or around Renfrew.

Municipal Trading.

At the meeting of the Joint Committee of the Houses of Lords and Commons on Municipal Trading on Friday, under the chairmanship of the Earl of Crewe, the whole of the proceedings were occupied with the evidence of Mr. W. J. Jeeves, the town clerk of Leeds and formerly deputy town clerk of Peterborough and town clerk of St. Helens.

Witness went over the whole range of the subject of municipal trading, and said that in the items of water, gas, tramways and electric lighting, municipal trading had been and was the definite outcome of the policy of Parliament as settled by public statute. He was perfectly certain that the actuating motive of corporations in taking up gas and water and other undertakings was not a pecuniary one, but was for the better service of the community in matters which were essential to its well-being. As an instance in point, he illustrated the close connection there was in large municipalities between the better housing of the working classes and improved facilities in transit by means of tramways, and personally he saw no possibility of solving the housing difficulty except by means of tramway extensions. But whether gas, water, electric lighting, or tramways were in the hands of corporations or companies, they should be in one set of hands. He considered that the present Parliamentary and departmental checks on the introduction of novel and experimental powers were quite sufficient—in fact, the reports of the Local Government Board were really a terror to municipal authorities. Notwithstanding that statement, he considered the Local Government Board reports were of great value. Experience had shown that in many cases it was necessary to sell or let gas or electricity fittings for the purpose of developing the consumption of the article. At St. Helen's it was found that neither the landlord nor the tenant would go to the capital expense of wiring the houses for electricity, though they would pay so much a year on account of the wiring. He did not think that that was hard on the traders and manufacturers of St. Helen's. He did not see why municipalities should manufacture such fittings which they could purchase from the manufacturers, but with regard to the traders, they could not undertake the work of the Corporation. The Corporation did not desire to compete with the retailer, and at Leeds the Corporation did not supply any fittings at all, although they supplied gas stoves.

Replying to Sir W. Foster, Witness said he would not go so far as to say that no retailer should ever be injured by Corporation competition, for if it was to the good of the general community—as it was in some places—there should be such competition. Unless, however, there was a balance of advantage, he did not think corporations ought to undertake competition, nor did he think they did so.

Proceeding, Witness went into the question of the working of the tramways by the Leeds Corporation, which were taken over by the local authority in February of 1894 only consisted of three miles of double line and 22 miles of single lines. Now there were 23 miles of double line and 49 miles of single lines, while the receipts had increased from £43,000 to £126,000. To carry out this extension very costly street improvements had to be effected. They

found no difficulty in large Corporations in getting good and competent men to serve on the various Committees. For instance, the directors of the Leeds Electric Lighting Company consisted of a civil engineer, two other engineers, a retired manufacturing chemist, and several merchants. On the Electrical Committee of the Leeds Corporation they had three engineers and four manufacturers.

The Committee adjourned till Tuesday.

The Committee met on Tuesday, the Earl of Crewe again presiding.

Mr. Moore Hayton, town clerk of South Shields, referred at some length to the evidence given by Mr. Swinton before the Committee, in which he referred to the case of Messrs. Sharp, a firm of Parliamentary agents, who offered him (Mr. Hayton) one-third of their fees if the Town Council appointed them Parliamentary agents in connection with the Tyneside Electric Power Bill. He (witness) replied that he was not empowered to take any part of the fee. The question of giving the fee to the Council was never discussed.

Viscount Hampden: You spoke of the Tyneside Electric Power Bill; was that Bill to supply power in bulk?—Yes; to local authorities and manufacturers.

And at a cheaper rate than you were manufacturing?—There was no guarantee that it would be cheaper, and the scheduled rates were not cheaper than the rates which were being charged by some undertakings in the district, although they held out the hope that they would supply cheaper.

Mr. George Livesey, of the South Metropolitan Gas Company, gave evidence relating to the gas supply, and maintained that it was in the interests of the consumer that gas should be supplied by companies rather than by municipalities.

Mr. J. Kelly, a member of the Board of Management of the Traders' Defence Association of Scotland, a body consisting of some 3,700 members, and containing both wholesale and retail traders, said he would restrict municipal enterprise to the supply of gas and water. Regarding electric lighting, he said that he thought the citizens of Glasgow had a grievance against the Corporation in that they obtained a provisional order, but did not put it in force. He presumed their object in obtaining the order was to prevent a private company coming in. The public interest in Glasgow suffered from that attitude on the part of the Corporation, and as a matter of fact several private firms were forced to put up their own installations. He believed, too, that the Glasgow Corporation had taken up the telephone simply in opposition to the National Telephone Company. They stood in the way of the company making their system more perfect, by refusing to allow facilities for improving it.

Mr. Shepherd, a master builder, and a former member of the late Metropolitan Board of Works, followed with evidence tending to show the unfairness of municipalities being allowed to indulge in building operations.

Liverpool Overhead Railway.

The Bill of the Liverpool Overhead Railway, which has already passed the various stages in the House of Lords, came before the Chairman of Ways and Means of the House of Commons on Friday and passed. The Bill refers to the construction of new lines, widening lift, further capital powers, &c.

Blackpool, St. Anne's and Lytham Tramways.

The Blackpool, St. Anne's and Lytham Tramways Bill came before the Select Committee of the House of Lords, presided over by Viscount Portman, on Friday. The Bill seeks to greatly extend the tramway system between the places mentioned at a cost of £50,000, and to work the whole system by electricity. It was stated that all the opposition to the Bill had been withdrawn, and it was accordingly referred to Lord Morley's Committee on unopposed Bills.

LEGAL.

Othen *v.* The Electrical Undertakings, Limited.

In the Chancery Division of the High Court of Justice on Saturday (July 14th), Mr. Justice Cozens-Hardy had before him a debenture stockholder's action against the company and the trustees of the deed. All parties consented to take the judgment in the settled form with the appointment of a receiver and manager. Mr. Justice Cozens-Hardy appointed Mr. C. E. Hare receiver and manager, to act as manager for four months, but would not give liberty to the receiver to borrow £500 to carry on the business, stating that the parties would have to take out a summons in Chambers for that purpose.

CORRESPONDENCE.

Bicycles and Icicles.

May I venture to invoke the powerful aid of your influential paper for advice anent the following matter: the applicability of electrical motor power. Electricity is now used as a motive power with indifferent success as regards the propulsion of vehicles, and the ignition of cycle and other lamps, if we, the luckless owners of such articles, chance to be remote from a charging station; but on the other hand, if you chance to be within a few yards of such charging stations, nought could exceed the utility of electricity, either as an illuminant, or as a motive power, and I daresay that not a few barbers use it for the revolution of the brushes used for "hair brushing by machinery."

But now let me kindly ask those of your readers conversant with the applicability of electrical energy to be so good as to advise me anent the following points:—

Can I have my cycle house (which is already illumined by electricity) fitted up with any sort of appliance for brushing my cycles and polishing them? Surely if dentists can have an appliance of the sort I now have in my mind fitted up in their consulting rooms for drilling teeth, it ought not to be such a very hard matter to have a like contrivance fitted up in a cycle house for cleaning a cycle, seeing that the "bits" used would never be larger than a lamp chimney brush. And then, again, as regards culinary operations:—

Is there no means whereby electricity can be adapted to rotate the cylinders of an ice-cream-making machine?

Henry James Saint Benno Cunliffe, M.A., Oxon.

New Club, Brighton.

Destruction of Underground Cables.

We shall be glad to know whether those of your readers who are in the habit of using armoured underground cables have found that they will not stand in certain localities. We must confess that we have been exceedingly fortunate in this respect, as, although we have armoured cables laid in almost every part of England, we have invariably found them to last well. One, however, which recently failed in insulation, was found, when dug up, to be corroded through and useless. The makers write to us as follows:—

Referring to your letter of July 2nd, we have made careful test of the sample of the soil you were good enough to send to us, and find that this contains considerable quantities of sodium and potassium chlorides and sulphates, which will fully account for the deterioration of the lead and armouring. Considering the presence of these chemicals, we think the cable has stood remarkably well, and even now the rubber is in first-class condition. Naturally, cable makers cannot prevent such deterioration if they are not warned in advance that the soil is a dangerous one for cables.

(Signed) The Telegraph Manufacturing Company.

This really opens up a most important question for contractors, if in future it is necessary to have samples of the earth in which the cable is laid, sent for analysis before the work is put in hand.

Drake & Gorham.

Westminster, *July 13th*, 1900.

The Towns' Refuse Problem.

I have to thank the writer of the article for his ministerial anecdote, but I regret that the lesson he desires me to draw from same does not commend itself to me as having any bearing whatever upon my statements. I am not aware that I have misconstrued or misquoted any statements made by your contributor, and most certainly I had no intention of offending him. I am in perfect harmony with him when he says that the primary function of a destructor is to destroy rapidly and completely; further, I agree with him that steam raising is of secondary importance, naturally that must always be so, but I must again most emphatically repeat that with a properly designed plant, thorough cremation must inevitably produce power, and here I part company with your correspondent, who evidently does not think that thorough cremation and power production are possible, let alone inevitable.

Time will prove all things, and I cannot but think that in the future more extraordinary work will be done with refuse, it is but a natural evolution, and although to the lay mind it may appear inconsistent, yet one cannot get away from the fact that some 15 years ago when one cell produced 5 I.H.P. per hour, the refuse was not thoroughly destroyed, and to-day when one cell often produces over 100 I.H.P. per

hour, the refuse is thoroughly cremated, and a temperature of combustion obtained which was not dreamed of in the earlier days.

I am pleased to see from this last letter by the writer of the article, that he does not appear to be quite so pessimistic as his article gave one to understand that he was, but still in these rapidly moving times one must admit that a destructor which only destroys refuse, and does not destroy same in such a perfect manner as to produce the maximum available power, must be altogether out of the running.

In conclusion, I should like to persuade the writer of the article to visit Darwen, when I am quite certain that every vestige of his pro-destructor ideas will vanish once and for all.

Incineratus.

June 16th, 1900.

[We have also received a letter from a correspondent who signs himself "Ignoramus," but as it abounds in personalities and can serve no useful purpose in connection with the controversy, we refrain from publishing it. We think also that the time has arrived for this correspondence to be closed, at all events, for the present.—Eds. Elec. Rev.]

The Maintenance of Electric Motors.

I have followed the correspondence *re* electro-motors in your journal with some interest. I have been using motors of all sorts and conditions for some time, and am of opinion that it pays well to get a first class machine in the beginning, and to look after it carefully.

Use carbon brushes in radial pattern holders, and if the motor is likely to be worked up to or over its full load for any length of time, don't use an enclosed machine. I was much interested some few weeks ago in looking over the engineering works of a large concern where a great amount of electric driving is in use; the machines were made by the electricity department of the same firm, and were of the enclosed type. I noticed that the mechanical department had altered the brush gear to a radial pattern, and had drilled large holes in the casing to allow of free ventilation, and I was informed that the machines were much better for the treatment.

With reference to starters, it seems to be a general complaint that there is no good starter in the market. My experience is that all the starters available are rated too high for their work, and are very expensive in first cost. For anything over, say, 4 H.P. I would recommend a lightly rated starter with a fast and loose pulley on the shaft or machine to be driven; it will cost less in first cost, less to maintain, and probably far less current in starting. If thought necessary, the striking gear can be made to work automatically in the event of the supply being cut off.

C. B. Callow.

St. Helens, I.W., *July 14th*, 1900.

Pocket Battery.

Will any correspondent be pleased to inform me of the lightest weight, smallest dimensions, and cost of a pocket battery; and if applicable for the heating of fluid, say half-pint, to boiling temperature?

D. B.

Railway Charges.

I read with great interest indeed your communicated article in current issue dealing with the relationship of the electrical trade and railway companies' charges for carriage of such manufacture.

As a railway official of some years' standing, and being engaged on the particular departmental work therein discussed, I can fully bear out the whole article.

The present classification is altogether inadequate to meet the large and rapid strides made in the electrical industry of recent years.

I am also directly interested in electrical undertakings, and in many cases have used my own discretion in classing (the consequent charges being affected by this, excepting special rates, an important point omitted in your article) consignments from manufacturers, their particular manufacture being known to me, but in some cases my classification has been challenged in favour, of course, of a higher class, and consequent higher charges; in such cases I have had to submit to the auditor's ruling, and act accordingly.

As pointed out in your article, it should not be a difficult matter at all, for representative manufacturers with the aid of a qualified railway official versed in the particular technicalities of the departmental work, and better still, if generally acquainted with electrical manufactures, to formulate some definite proposal to submit to the Railway Clearing House authorities and the various railway companies.

The cost divided would be a mere trifle, and I feel perfectly sure that the result would warrant their taking the initiative in the matter, and place the trade generally upon a better footing than they at present enjoy.

Equity.

Birmingham, *July 18th*, 1900.

REVIEWS.

Up-to-Date Domestic and Industrial Applications of Electricity. By "Alpha." London: S. Rentell & Co., Limited. 1900.

This is a sort of "Alpha in Wonderland" story-book for the householder, describing the adventures of the author ("himself an electrical engineer and inventor") in an electrical museum, which he visited the other day, in summer time (had he sun-stroke?), but the whereabouts of which has slipped his memory.

Perhaps it is as well.

The wonders began at the very entrance. Here there was an apparatus which indicated (on pressing a button) whether the museum was "at home" or "not at home"—a function usually performed by means of a simple shutter, or a piece of paper pinned to the door. On pressing the *same* button again, the door opened to admit the explorer, who immediately began to take notes. The door was burdened with a key-alarm, a key-hole illuminator (specifically intended for inebriates), an alarm letter-box, an automatic lamp switch, and a burglar alarm. In the hall, a hat polisher, an alarm hat-rack, a cigar lighter, an ozoniser, a snap-shot camera, a third burglar alarm, an alarm mat and a boot polisher, were inspected. The victim proceeded to examine in all about 260 different items, through which we leave others to follow him—if they choose.

The devices range from hunting tigers and curing chilblains to an electric overcoat for Polar expeditions and an automatic alms distributor!

While a few of the applications of electricity touched upon may be of value, the vast majority are perfectly useless, except as curiosities, while the descriptions are most meagre. The author's style is not too attractive; such phrases as "crammed my stomach," and "that blooming bottle," are the reverse of choice.

It is said in the preface that the book serves for "educative (*sic*) purposes." For our part, we fail to see why it was written, or who is likely to read it.

The Elementary Principles of Electric Lighting. By A. A. C. Swinton. Fourth Edition. London: Crosby Lockwood & Son. 1900.

This little book is intended by the author to supply the wants of those who, not having time to study the subject deeply, are yet desirous of obtaining an elementary knowledge of its fundamental principles; the subject is therefore treated in a typically "popular" style, and with the simplest language.

Elementary explanations of the more common electrical terms and units, and of their mutual relations, occupy the opening pages, after which come "diagrammatic" descriptions of ordinary apparatus for the production and use of electricity, into which we need not enter, save to point out one or two slight errors for correction in future issues.

For example, in the diagram of an alternate current dynamo on p. 29, the current is indicated as flowing in the

wrong direction, while in that of the direct current dynamo on p. 37 one of the field magnets is wound the wrong way; and the incandescent lampholder, shown on p. 46, one of the old wooden "bottom loop" type, has gone out of use.

No doubt the book will be of service to those to whom it is addressed.

Electric Tramway Traction. By A. D. Greatorex. London: St. Bride's Press, Limited.

As the preface indicates, this work consists mainly of a reprint of a paper read before the Incorporated Association of Municipal and County Engineers in June last year by the author, who is the borough engineer and surveyor at West Bromwich. The material has, however, been revised and brought up to date.

There is a great deal of general descriptive matter relating to the various overhead trolley, conduit, accumulator, combined trolley and battery and surface contact tramways, many photographic illustrations being reprinted from technical journals, and various explanatory diagrams included.

The question of working costs is not overlooked, for figures are given showing the results obtained on the Leeds, Dover, and Blackpool lines. Altogether, we should think this work should be of service to those who wish to obtain some general knowledge regarding electric tramway systems.

The Cyanide Process of Gold Extraction. By James Park. London: Charles Griffin & Co., Limited.

This work having passed successfully through three editions in New Zealand, is now slightly revised and presented as the first English edition. As one of "Griffin's metallurgical handbooks," it requires no comment upon its style and type. It is complete and concise, and the author, with a good theoretical and practical knowledge, expounds the general principles and practice of the cyanide process, adding not a small amount of information which is both useful and new. There are eight plates and four woodcuts illustrative of the necessary plant, all of which are well produced.

Chaps. I. and II. deal with the chemistry of the McArthur-Forrest process, and show both the theoretical and practical influence of atmospheric oxygen upon the dissolution of gold in solutions of cyanide of potassium. The action of impurities in the ores upon such solutions is also dealt with.

In Chaps. III. and IV. the author deals with the establishment of a works laboratory, and describes the methods of experimenting required to control the composition and strength of the solutions used in the works. Examples are given to aid the student in performing the various analyses. In the latter chapter some useful tables and constants are also included.

In Chap. V. are given full particulars of the construction of "the appliances for cyanide extraction," including the dissolving and leaching vats and extractors. These are taken from actually existing plants in New Zealand and Australia. The costs of materials and construction of plants of various capacities are also given.

Chap. VI. is devoted to "The actual extraction by cyanide," and describes the general *modus operandi* of the process, the latter part of the chapter dealing with the best methods of wet and dry crushing and the treatment of slimes. In Chap. VII. is given information relating to practical leaching and washing, treatment of slimes, &c., in New Zealand, South Africa, Australia and America, in which the costs of the different operations are noted. The author expresses the opinion that the States have been slow in taking up the cyanide process, probably because their ores are unsuitable, whereas New Zealand has gone ahead in this respect on the reverse account. Leaching by agitation is next dealt with in Chap. VIII., and in Chap. IX., the precipitation of gold from cyanide by zinc and the purification of the solutions is described. Gold precipitation by means of charcoal is condemned as being too cumbersome for actual practice.

The electro-chemical precipitation of gold from weak solutions by the Siemens-Halske process is discussed in Chap. X., and figures are given which compare very favourably with those for the extraction by zinc.

In Chap. XI. a short description of the principles of those other variations of the cyanide process which promise success is given, including "The Hanway Electro-Cyanide Method," "The Park-Whitaker Cyanide Process," "The Keith Electro-Cyanide Process," and "The Sulman-Teed Process."

Chap. XII., upon "Antidotes for Cyanide Poisoning," gives, in addition, some useful hints upon the prevention of the contamination of the atmosphere with hydrocyanic acid and arsenuretted hydrogen vapours in gold extraction works.

Lastly, an appendix is added upon "Cyaniding in New Zealand."

In conclusion, we may add that the work is a valuable addition to the literature upon gold and silver extraction, and should be in the library of every metallurgical works and college. It is interesting to read, but is essentially a book of reference, and for this reason it is to be regretted that the *index* is not much more complete.

THE ELECTRIC LIGHTING AND TRAMWAYS OF BUENOS AIRES.

(*Continued from page* 65.)

The monocyclic generators are of the revolving field type, thus avoiding slip rings and brushes for the high tension current; the question of insulation is also simplified, as there are no mechanical strains produced by the high speed of the armature coils. The frame of the armature is of cast-iron of a strong box section, into which are securely fastened the iron punchings of the core. Ventilating spaces between the armature laminations provide for a circulation of air when the machine is running. The coils are set in slots and are held in place by wedges driven over them. The supplementary or power winding is connected with the principal winding at its central point in the machine, thus leaving only three connecting terminals. The armature coils can readily be replaced in case of a burn out. The armature is mounted on sliding rails and can be moved to one side until the revolving field is fully exposed for examination; then by removing the shields at either side of the armature frame the armature coils are made accessible for inspection or repairs. The field structure consists of pole pieces mounted on a cast-steel ring and carried on a cast-steel spider. The pole pieces are of laminated iron, spreading at the pole face so as to cover a wide polar arc and hold the field winding in place. They are attached to the steel ring by bolts passing through them; this permits of rapid removal of the coils and pole pieces if necessary. The field coil consists of a single strip of flat copper wound on edge so that the surface of every turn is exposed to the air for cooling; as the flat sides rest against each other, the entire coil forms a structure of great solidity. There are 48 field coils, taking their exciting current through two cast-iron slip rings equipped with carbon brushes, which require no attention. The revolving field structure acts like the fan in a blower, forcing the air outwards through the openings in the armature laminations.

The steam exciters are multipolar compound-wound machines direct coupled to the engines. They run at 325 r.p.m., the output being 30 kw., at 130 volts. The other exciter is a dynamo of similar type and equal capacity, but it is driven by a 50-h.p. 8-pole three-phase motor through a flexible coupling, its speed being 750 r.p.m. The current for this is taken from two transformers with a ratio of 1,560 to 230, one terminal of each of which is connected to the power wire, the others to the outers of the principal circuit; by making the proper secondary connections, three-phase currents with very nearly equal voltages are delivered to the motor. There is a starting resistance for the armature, which rotates with it, and is cut in and out by a handle which moves a sliding ring on the shaft.

There is a six panel switchboard for the generators, four panels being for the alternators and two for the exciters; a little to the rear and on one side is the seven-panel feeder board. All the boards are of polished white marble, and are supported by angle iron frames, the switchboard gallery being carried on a girder iron structure.

The cables coming from the generators to the panels are connected to the switchboard through a three-pole quick-break switch, mounted on the rear of the generator panel at the top, and operated by means of a handle on the front.

All contacts are mounted on ebonite pillars and placed on opposite sides of a marble insulating plate, so that no arcing can take place between adjacent terminals. Each panel carries a watt-hour-meter, hot wire shunt ammeter, regulating rheostat handle, voltmeter switch and exciter ammeter.

The exciter panels are fitted with ammeters, voltmeters, shunt rheostats, double-pole main switches and equaliser switches.

A small swing panel carries two hot wire voltmeters, and the synchronising lamps; one voltmeter is fed from the bus bar transformer connected to the generator panel for use when synchronising. This panel swings out at an angle from the board so that it can be read from any field regulating switch. All the electrical measuring instruments were made by Hartmann & Braun.

The feeder board is divided into two equal sections, the load on them being kept approximately the same through careful judgment in the distribution of the load in the city over the various circuits. Under normal conditions, when parallel running, these two sections of the feeder board are connected together by a quick-break three-pole switch. If necessary, however, one generator or group of generators can be connected to one half, and the other fed by another group, the division of the load being effected by opening this three-pole switch.

Each panel of the feeder board is provided with an easily changeable type of fuse carrier; there are also short circuiting switches for the boosters.

Above the feeder boards are four sets of three-pole double switches, one for each alternator, by means of which any alternator may be thrown on to a set of bus bars for driving the synchronous motors of the tramway section.

A small panel is provided for the pilot wires running back from the principal stations of distribution.

The floor in front of the switchboard consists of plates of one inch glass, covered with rubber matting.

A storage battery is about to be installed as a reserve for excitation; special connections will allow the station lighting or part of it to be fed from the same source in case of emergency, and the motor-driven fire extinguishing pumps will take their current from the battery.

The electric overhead traveller has a span of 22 metres, and is capable of lifting 20 tons, the three motions being effected by three separate motors, controlled from a cage slung under the crane in the usual way. In this cage is a small switchboard containing an ammeter and double-pole switch, and alongside are the three controllers. Those for the travelling and traversing motions are controlled by one lever with a ring universal joint, so that it can be moved in four directions; the inclination of the lever from the vertical is followed by the advance of the traveller or the crab (as the case may be) in the direction of that inclination, and notwithstanding that there is only one lever for these two motions both crab and traveller can be put in motion at the same time.

The lifting motor is controlled in the same way, the controller lever being raised when the motor is to lift and depressed when it is to lower, so that the attendant cannot easily make a mistake. A solenoid in series with the lifting motor actuates a friction brake, throwing it on immediately the current is off.

The current is collected from two trolley wires stretched from end to end of the building; the crab is supplied in a similar way from trolley wires which extend the whole length of the traveller. The motors are all of the enclosed type with consequent poles, and are fed from the exciter bus bars.

The contract for the supply of the whole of the plant, including the erection, was awarded to the Union Electricitäts Gesellschaft, of Berlin; they were also the builders of the dynamos and switchboards. As, however, this company exploits the General Electric Company's patents in Germany, the design of the electrical apparatus follows closely that of the American company.

In the engine room of the temporary station there is a multipolar 500-KW. 500-volt dynamo, direct coupled to a McIntosh & Seymour vertical triple expansion three-crank engine, running at 125 r.p.m. Its cylinders are 14 inches, 23 inches, and 40 inches diameter × 36 inches stroke; the valves are all of the gridiron type, steam and exhaust being worked by a separate eccentric for each cylinder. There are gridiron expansion valves on all cylinders; these work on the backs of the steam valves, and are driven by three separate eccentrics, all three being controlled by a fly-wheel governor. The speed is practically constant, notwithstanding the enormous and sudden variations of load incident to tramway service. This engine always works condensing, but it can, if necessary, exhaust to the atmosphere. The condenser is similar to those in the new station; it can take its water either from the river or from an artesian well.

There are also two other tramway generators, one of 225 KW., and the other of 100 KW. These are belted to two McIntosh & Seymour's compound tandem engines, with cylinders 11 and 19 inches diameter × 23 inches stroke, running at 230 r.p.m.: they are fitted with piston valves, the cut-off of the high pressure valve being controlled by a fly-wheel governor. These engines are also connected to the condenser.

The dynamos in this station were all built by the General Electric Company of Schenectady, and run absolutely without sparking up to 20 per cent. overload. There is also a 100-KW. monocyclic alternator of the revolving armature type, arranged so that it can be belted from the 100-KW. tramway dynamo, the latter running as a motor, taking its current from the tramway bus bars, or the alternator can be run as a synchronous motor from the bus bars in the new station. This combination is used for either minimum tramway load or minimum lighting load.

In the boiler house are three Babcock & Wilcox boilers, fed by two Worthington duplex pumps. These boilers, however, are no longer in use, steam for this station being taken from the Belleville boilers since the new plant has been erected.

In a small temporary building adjoining the new station there has been installed a 225-KW. tramway dynamo identical with the one previously described. This one is belted off the fly-wheel of one of the Allis engines; it works, however, in conjunction with the other tramway dynamos.

The switchboards in the temporary station are of enamelled slate, there being five generator panels and eight feeder panels. The generator panels are provided with G.E. circuit breaker, shunt ammeter, shunt regulating resistance switch, and two single-pole quick-break main switches; the feeder panels contain circuit breaker, ammeter and single-pole switch. There have lately been added one B.O.T. voltmeter panel and seven panels for boosters and negative feeders.

There are also three 1,000-ampere watt-hour-meters for measuring the total output of the tramway section, and two negative boosters driven by shunt wound motors.

(To be concluded.)

BUSINESS NOTES.

Book Received.—"Mechanical Traction in War," by Lieut.-Col. Otfried Layriz, of the German Army, and translated by R. B. Marston. London: Sampson, Low, Marston & Co. 1900.

Private Bills.—In the House of Lords on Monday the following Bills were read a third time and passed:—Jarrow and Hebburn Electricity Supply, Hastings Tramways. In the Commons the following Bills were read a third time:—County of Durham Electric Power, Lancashire Electric Power, and South Wales Electric Power.

Outing.—The employés of the "Robertson" Lamp Works held their annual excursion on Saturday last, when a party of over 200, accompanied by the staff, spent a most enjoyable day at Hastings.

Trade Announcements.—We are informed by the British Electric Works Company, Limited, that they have appointed their Leicester agents, Messrs. Gent & Co., Faraday Works, to represent them in Newcastle and district also, where they are carrying on business at Highbridge. Further, Mr. S. Haynes has been appointed agent for Nottingham, where his address is 13, Castlegate.

The premises of Mr. A. P. Lundberg, at Liverpool Road, N., were broken into on 14th inst., and valuable tools taken. In case correspondence may have been interfered with, customers are asked to write again if their letters have not been attended to.

Electrical Wares Exported.

WEEK ENDING JULY 10TH, 1899.		WEEK ENDING JULY 17TH, 1900.	
Amsterdam	Value £30	Alexandria	Value £51
Boulogne	1,000	Amsterdam	51
Brussels	90	Bangkok	1·0
Buenos Ayres	1,426	Boca	1,141
,, Elec. cable	900	Bombay	216
,, Teleg. wire	264	Brisbane	26
Calcutta	263	Buenos Ayres	169
Cape Town	490	,, ,, Teleg. mat.	914
Christiania	61	Calcutta	482
Colombo	218	,, Teleg. wire	260
Copenhagen	80	Christchurch	44
Durban	277	Colombo	85
East London	517	,, Teleg. mat.	35
,, Teleg. mat.	1,476	Constantinople	10
Gothenburg	40	Copenhagen. Teleg. wire	478
Hamburg	110	Demerara. Teleg. mat.	150
Hong Kong	595	Durban	395
King George's Sound	67	,, Teleg. mat.	151
Leghorn	52	East London	442
Lyttleton	60	Fiume	21
Malta	195	Ghent	15
Marseilles	36	Gothenburg	25
Mauritius	27	Hamburg. Teleg. mat.	830
Ostend	20	Hong Kong	295
Port Elizabeth	355	Liban	10
Rio Janeiro. 105 tons teleg. wire (value not declared)	—	Madras	14
Shanghai. 26 tons old teleg. wire (value not declared)	—	Mauritius	175
Singapore	40	Melbourne	111
,, Teleg. stores	40	Ostend	11
St. Petersburg. Teleg. cable mat.	285	Perth	16
Stockholm	9	Port Elizabeth	710
Sydney	28	St. Petersburg	250
,, Teleg. cable	668	Shanghai	127
		,, Teleg. mat.	126
		Stockholm. Teleg. mat.	225
		Sydney	146
		Valparaiso	50
		Yokohama	349
Total	£9,454	Total	£8,256

Foreign Goods Transhipped.

Melbourne. Telephones	Value £48

Bankruptcy Proceedings.—A receiving order has been made against Leonard Francis, electrical engineer, Southwold, on a creditor's petition. The first meeting of creditors and public examination are arranged for July 21st at Norwich and July 24th at Yarmouth respectively.

Notice is given of release of trustee (Mr. E. T. Peirson) in the case of H. J. Wimshurst, electrical and motor-car engineer, Coventry.

At a sitting of the London Bankruptcy Court held last Wednesday, before Mr. Registrar Gifford, Fredk. George Wm. James Adams, electrical engineer, lately carrying on business in partnership at 24, Newman Street, Oxford Street, W., as Downie & Adams, applied for an order of discharge. Mr. E. L. Hough, senior Official Receiver, reported that the bankrupt failed in September, 1899, and returned a liability of £1,000 due to his father. He also scheduled liabilities of £2,142 7s. 9d. due from the firm of Downie and Adams, but treated them as not expected to rank on the ground that the firm was not insolvent. That, however, was not the case, as from the examination of the Official Receiver it appeared that the value of the partnership assets, which consisted only of certain book debts, was small and far below the amount of its unsecured indebtedness. Proofs of debt were made for sums amounting to £1,601 14s. 1d., and included a claim to £1,000 by the bankrupt's father. So far as the Official Receiver could judge, the bankrupt had under-estimated the outstanding indebtedness of the firm of Downie & Adams by about £200. No realisable assets belonging to the bankrupt were disclosed in the statement of affairs, and only 4s. 8d. was realised. The bankrupt and a partner, in February, 1897, with £1,000 capital, which was provided by the bankrupt, who obtained it on loan from his father, commenced business as electrical engineers, under the style of Downie & Adams, at Bush Lane House, Cannon Street, E.C., but in June, 1897, removed to 24, Newman Street, W. In January, 1899, in consequence of a quarrel, his partner ceased to attend to the business, and except for a short time in March, 1899, did not afterwards take any part in its management. In July, 1899, the bankrupt, being in difficulties, surrendered the lease of the premises, and abandoned the business. He had previously handed a large part of the stock to pressing creditors, and had sold other stock at much less than cost to his father for £180 (which was paid to pressing creditors), whilst the fixtures and remainder of the stock were left on the premises against rent due. The bankrupt attributed his failure to loss (in consequence of bad debts made by the firm) of the capital contributed by him to the partnership, and to the unauthorised drawings of his late partner. He had alleged that it was only in June, 1899, that he became aware that he was insolvent, and that the fact was brought to his knowledge by his inability to get in the partnership debts, and by his partner's refusal to refund £696 which he (bankrupt) contended had been improperly withdrawn from the firm. No liabilities were contracted subsequent to June, 1899. The offences alleged by the Official Receiver were insufficiency of assets to pay the creditors 10s. in the £, and imperfect book-keeping. The bankrupt, in putting forward the application, said the failure was entirely due to his partner's action, and it was hard that he should be called upon to suffer ignominy for the fault of another. His Honour upheld the Official Receiver's report, and imposed a further suspension of two years.

Liquidation.—The Brockie-Pell Arc Lamp, Limited, has passed resolutions winding up voluntarily for the purpose of reconstruction. Mr. D. F. Basden, of 33, St. Swithin's Lane, E.C., is liquidator. The name of the new company will be the same as that of the old.

Catalogues and Lists.—Messrs. Arthur Cort & Co., of Camberwell New Road, have issued a wholesale price list of insulating hard or flexible fibre for electrical, tramway and various other purposes.

The British Westinghouse Electric and Manufacturing Company's circular No. 1,028 (July, 1900) is devoted to rotary converters. The work they have to do, their mechanical construction, and other matters of general and descriptive interest, are gone into, and a number of views of converters supplied to various power stations in America are given.

An illustrated price list of "Improved" electric fan motors for desk, wall and ceiling use, for continuous or alternating supply, comes to hand at a convenient moment from the Improved Electric Glow Lamp Company, of Queen Victoria Street. There should be a good demand for cooling fans if the present hot weather continues, and no doubt this newly constructed company will secure its share of the business.

From Messrs. Tangyes, Limited, there come to hand some exceedingly neat lists relating to their gas engine ("Otto" principle, Pinkney's patents), and their horizontal steam engines. A third (the Factors' catalogue) illustrates and prices a variety of pulley blocks, hoisting crabs, lifting jacks, engine governors, pumps, steam traps, and other steam and mechanical apparatus. All of the lists are well illustrated, and the general arrangement, good printing and enamelled paper, combine to produce very presentable catalogues.

The Atlas Carbon and Battery Company, Limited, of Ewer Street, S.E., are sending out a booklet giving a few particulars and prices of their "Dania" dry cells, and the claims which they set up for them.

Messrs. Veritys, Limited, are circulating lists of their Lundell motors $\frac{1}{12}$ to 3 H.P., which they are pushing with a view to superseding gas engines in printing and other factories. The rising price of gas is the great argument by which a change is advocated.

Messrs. Bergtheil & Young send us an illustrated list of the "Bandy" electric fans and ventilators for continuous and alternating supply.

For Sale.—The Leeds Corporation electric lighting department offers a considerable quantity of second-hand high tension india-rubber cable for sale. Inquiries should be addressed to the department, 1, Whitehall Road, Leeds.

The Whitechapel District Board of Works are inviting tenders for the purchase of an electric lighting set (12-H.P. Stockport gas engine, and 100-volt compound-wound Castle dynamo, belting, switchboard, &c.). See "Official Notices" to-day.

Turbo-Alternators for Frankfort.—The newly-formed Brown-Boveri-Parsons Syndicate have received an order from the Frankfort Corporation for a 4,000 H.P. turbo-alternator for the extension of their central station, the actual capacity of which is four 500-KW. units and two 1,000-KW. units, while two more 1,000-KW. units are being erected. It is interesting to note in this connection that, although a single-phase plant, yet the total capacity of the motors connected to the Frankfort mains exceeds 5,000 H.P., which is the best possible proof that a properly proportioned single-phase installation compares favourably with others even as regards power distribution. At all events, there is no town in England which can show a motor load approaching that of Frankfort. The fact that the Frankfort Corporation, acting on the advice of their resident and consulting engineers and on the report made by a committee of eminent engineers, have decided to adopt steam turbines speaks well for these generators, the more so because all the machines installed in the Frankfort central station up to the present were built by the most renowned Continental firms. The turbo-alternator which has been ordered will run at a speed of 1,360 revolutions per minute, giving current at a pressure of 3,000 volts. It will be capable of giving its full output of 4,000 H.P. when working on an inductive load having a power factor of 80 per cent. The alternator will be provided with a special winding, by means of which it can be made to generate three-phase current, in which case its output will be 5,000 H.P. The set will be by far the largest turbo-alternator ever made, and, moreover, will rival in power the largest reciprocating steam engines ever built for direct connection to electrical machines.

Ventilation.—We have before us a small pamphlet on "Upward *v.* Downward Ventilation," in which appear extracts from a report prepared by Prof. S. H. Woodbridge, on the ventilation of the Capitol, Washington, U.S.A. Experiments at the Berlin new House of Parliament, showed the down-draught ventilation to be inferior to the up-draught system, which Prof. Woodbridge considers is in every way effective if properly arranged. The pamphlet also contains excerpts from the report laid before the U.S. Congress by the Government Commission on ventilation, in which the relative merits of the two systems are discussed. The publishers are Messrs. Robert Boyle & Son, Limited, of Holborn Viaduct.

ELECTRIC LIGHT AND POWER NOTES.

Barking.—The Local Government Board will not allow the Council to bring forward to this year's accounts the deficit on the working of the electricity undertaking to March 31st. The Lighting Committee has deferred for the present the question of dealing with the deficit.

Bath.—The Electric Lighting Committee has passed a resolution in favour of giving a commission of 1s. for every lamp installed by wiring contractors, provided that they have their own premises wired and employ canvassers.

Calcutta.—In the first 3½ months of the present year, the Calcutta Electric Lighting Company has supplied almost the same number of units as in eight months of last year, and the demand is increasing so rapidly that the company has just doubled its capital. This, says the *Times of India*, is a more satisfactory story to tell than that which is furnished in Bombay, where the committee of the Corporation having played with the subject at various meetings, has adjourned for six months to see if the municipality can squeeze a share of the profits out of any undertaker who is willing to bid for the concession. We see no trace of this huckstering disposition in Calcutta, where the company have obtained from the Government of Bengal an extension of their concession to 42 years. Already there is so large a demand for power for working fans and punkahs, that the Calcutta company anticipates that this will more than make up for the falling off in the requirements for lighting in the summer months.

Castle Donington.—A scheme is on foot to utilise the water power at King's Mills for electricity supply to Castle Donington and the neighbouring towns and villages. It is estimated that 500 H.P. is available.

Chatham.—At a meeting of the Corporation last week the report was read of a committee which had been appointed to consider a proposal to purchase the plant, &c., of the Chatham Electric Lighting Company. The committee had met the chairman and directors of the company and discussed matters, and now asked that an expert should be employed to make a valuation. This was agreed to.

Cupar Asylum.—The Fife and Kinross Lunacy Board has considered Bailie Mackenzie's report on the electric lighting of the Asylum, the initial cost of which is estimated at £3,150, and has decided to obtain specifications and estimates.

Dorking.—The increased price of gas has led the Council to resolve to transfer its electric lighting provisional order to a company, and tenders are now being invited therefor.

Dublin.—A serious breakdown occurred in the electricity supply over a large part of the city last week. The cause was not divulged.

Dunstable.—Two notices of intended applications for provisional orders have been received by the Town Council. These are from the North British Electricity Supply Company, and Messrs. F. T. & A. Garrett & Co., a local firm of electrical engineers. These applications have had an excellent effect upon the Council, who are now going to seriously inquire—through a committee which has been specially appointed—into the probable cost of an electricity undertaking, and the desirability of applying for a provisional order for municipal working. It seems certain that a scheme will be taken in hand either by one of the applicants or by the Council itself, for as well as the pressure which private enterprise is bringing to bear upon the Council, there has been a considerable increase made in the charges for gas by the local gas company. Messrs. Garrett's provisional order if granted, would cover supply to the adjoining urban district of Upper Houghton, and the population of the two districts is about 7,000. There are several important private installations running in the neighbourhood, including an electric light and power plant at Messrs. Waterlow Bros.' large works, a lighting plant in the engineering works of Messrs. J. Harrison Carter, and Alderman F. T. Garrett (ex-mayor, who is now promoting the order for which a local company is proposed) has had a gas engine plant for lighting his own premises and workshops for some years past.

Folkestone.—The Electricity Supply Company proposes to adopt high pressure transmission from its outside generating station to transforming sub-stations in the town, distributing from these on a 420—210-volt three-wire system.

Gloucester.—The formal ceremony of switching on the electric light was performed yesterday by the Mayor (Mr. Frank Treasure).

Horsham.—The Local Government Board has asked for plans and further particulars of the Council's scheme, for which it proposes to raise £15,000.

Italy.—A central electric lighting station has just been completed at Laurea. Water-power is utilised by Riva turbines of 300 H.P., driving continuous current dynamos, supplied by Messrs. Gadda & Co., of Milan.

Kelsall.—There is an electric light project on foot in this village.

Kilmarnock.—The Secretary for Scotland has decided to hold a local inquiry with regard to the application by the Town Council for a provisional order for borrowing powers to the extent of £50,000, of which it was proposed to spend £30,000 on electric lighting, and £20,000 on the extension of the gas works. The Council has decided to withdraw the present application for a provisional order, and has instructed the different committees to report as to what sums are required for their respective departments, so that a new provisional order may be applied for in the autumn.

Lancaster.—The Local Government Board has sanctioned the Council's application for £20,000 loan for electricity plant extensions.

Leamington.—July 13th was the last day allowed the Corporation by the Board of Trade under the Electric Lighting Order, provisionally granted to them in the session of 1899, to come to an agreement with the Midland Electric Light and Power Company. No such agreement having been arrived at, the Corporation's order lapses, and the Electric Light Company secures a provisional order.

Limerick.—Mr. P. C. M'Cowan, Local Government Board inspector, held an inquiry last week into the application of the Borough Council for a loan of £20,000 for the purpose of providing an electric installation for the lighting of the city.

London. — SHOREDITCH. — The Finance Committee reported at a meeting of the Vestry on Tuesday having considered the following report of a special sub-committee appointed to consider the question of outstanding accounts:—

Your Committee beg to report that in accordance with the resolution of June 25th, 1900, they have held three meetings for the purpose of investigating the outstanding accounts due to the Vestry as directed. The officers concerned were examined as to the outstanding accounts in 94 cases, 42 being for electricity supply, 16 for wiring and fitting work, 5 for dust destruction, 21 for removal of trade refuse, and 10 other debtors for amounts due to different departments of the Vestry, the total being £379 7s. 8d., of which £96 3s. 11d. has been recovered through the action of your sub-committee. Directions were given in a number of cases for proceeding to be entered into by the Vestry clerk to recover the amounts, whilst sums amounting to £41 0s. 10d. were ordered to be written off as bad debts, the remainder being now in progress of collection. Your Committee are of opinion that the Standing Orders of the Vestry, with reference to the receipt of all moneys payable to the Vestry, should be fully exercised by the Finance Department.

The Finance Committee recommended the Vestry to adopt the following recommendations:—

1. That it be a Standing Order of the Committee that in the first week of each quarter the accountant shall prepare a list of outstanding accounts in all departments for the quarter before the last, and that the Vestry clerk take immediate action to recover the same.
2. That in the opinion of your Committee it is undesirable that credit accounts should be allowed in the case of small companies and others whose commercial standing is doubtful, without satisfactory references being given, or inquiries made through a trade agency, or a substantial deposit taken.

After considerable discussion the matter was adjourned for a month.

LONDON COUNTY COUNCIL.—The Council at the meeting on Tuesday resolved to lend £30,500 to the Whitechapel District Board for electric lighting purposes. The adjourned report of the Asylums Committee was again submitted in reference to the proposed central station for the supply of water and electricity to the asylums to be erected on the Horton estate. After some discussion the Council approved the scheme, and an expenditure of £39,000 for carrying out the work. The electric lighting scheme will comprise an installation of 3,800 lamps, equalling 8,187 lamps of 8-C.P. It will also provide the current for 16 motors, varying in size from 22 B.H.P. to 1 B.H.P., which will supply the motive power for water pumping, driving laundry machinery, bread-making machinery, ventilating fans and workshop tools, &c. The system proposed is the three-wire system with a voltage of 400 between the outer conductors, but in all rooms occupied by patients and staff the voltage is by a duplication of the wiring limited to 200, and this will also prevent a failure of light should one of the conductors break down.

Maidstone.—The District Council has decided to separate the scheme for a combined dust destructor and electric light works, and to, at present, have the latter only, the total cost being estimated at £35,000.

Manchester.—Mr. H. H. Law, M.I.C.E., held an inquiry last week on behalf of the Local Government Board relative to the application of the City Council for sanction to borrowing powers for £189,890 for electric lighting purposes. The deputy town clerk informed the inspector that the application was made in accordance with a resolution of the Council adopted in March, 1899, to ask for powers to borrow £500,000 for electricity purposes. The plans and details of the schemes for the expenditure of the whole of that sum were not yet ready, so that the Corporation only now asked for £189,890 for that portion of the work—a generating station—of which plans and details had been supplied to the Local Government Board. Mr. C. H. Wordingham, the electrical engineer to the Corporation, stated that the demand was growing at a rapid rate. In 1898 the demand increased by 31 per cent., and in 1899 by 43 per cent., and the existing plant was fully occupied. They hoped to have the first three sections of the city tramways ready towards the end of this year, so that, as there was often considerable delay in the delivery of electrical plant, it was imperative that this application should be made. There being no opposition, the inquiry was closed.

Nuneaton.—The Local Government Board has granted the District Council's application for leave to borrow £16,000 for electric lighting purposes so far as regards the purchase of the existing company's undertaking at a cost of £8,000, but has deferred sanction to the remainder of the loan until the Council has obtained expert advice on the proposed alterations and extensions.

Penistone.—The District Council is considering the adoption of electric lighting.

Poplar Sick Asylum.—The managers have decided to adopt electric lighting, and to invite Mr. Warden-Stevens to state his terms.

Provisional Orders are to be sought for—

Aberdare.—By a local company.
Aberfeldy.—By the North British Electricity Supply Company.
Blairgowrie.—By the North British Electricity Supply Company.
Brentford.—By Edmundson's Electricity Corporation, Limited, and the Richmond (Surrey) Electricity Corporation.
Cannock.—By the North British Electricity Supply Company.
Cowes.—By the Ventnor Electric Light Company.
Crieff.—By the North British Electricity Supply Company.
Cullen.—By the North British Electricity Supply Company.
Edmonton.—By the Middlesex and Hertford Electric Lighting and Power Company.
Enfield.—By the Middlesex and Hertford Electric Lighting and Power Company; Edmundson's Electricity Corporation; and the Electric Light and Traction Company.
Finchley.—By the Middlesex and Hertfordshire Electric Lighting and Storage Company.
Forres.—By the North British Electricity Supply Company.
Gainsbro'.—By the North British Electric Light Supply Company, and the United Electric Light and Traction Company, Limited.
Helensburgh.—By the North British Electricity Supply Company. The burgh will oppose.
Herne Bay.—By Messrs. J. W. Manly & Co.
Largs.—By the North British Electricity Supply Company.
Newburgh.—By the North British Electricity Supply Company. There is a considerable amount of water-power in the district.
Pinner.—By the North British Electricity Supply Company.
Pleasley.—By the Shirebrook Colliery, Limited.
Pudsey.—By the Northern Counties Electric Supply Company. The District Council will oppose.
Richmond (Yorks).—By the North British Electricity Supply Company.
Rickmansworth.—By the North Metropolitan Electrical Power Distribution Company, Limited, and the Middlesex and Hertford Electric Lighting and Power Company.
Rishton.—By Messrs. Tahourdius & Hitchcock.
Rutherglen.—By a company.
Ryton.—By the Tyneside Electric Power Company.
St. Margarets (Dover).—By Mr. E. H. Shaw.
South Bank.—By the Northern Counties Electricity Supply Company.
Stranraer.—By the North British Electricity Supply Company.
Stratford-on-Avon.—By the United Electric Light and Traction Company, Limited.
Swanage.—By the North British Electricity Supply Company, and the Bournemouth and Poole Electricity Supply Company.
Tettenhall.—By the Midland Electric Corporation for Power Distribution. (Council has appointed a Committee to consider the question of electric lighting generally.)
Wanstead and District.—By the County Electricity Supply Company.
Worsley.—By the South Lancashire Tramways Company.

Rhyl.—It is suggested that steps be taken to provide for future requirements of the electric light works at an additional cost of £6,216. The matter has been referred to the committee.

Sleaford.—The District Council's provisional order has received the Royal assent, and Mr. B. Smith, the engineer, having estimated the cost of the electrical installation at £6,500, the Council has resolved to petition the Local Government Board for power to borrow £7,000.

South Shields.—A Local Government Board inquiry was held last week with regard to the application of the Corporation for sanction to borrow £36,750 for electric lighting purposes.

Southampton.—The increased demand for energy has rendered additions to the business staff necessary.

Southport.—The report submitted by Mr. C. D. Taite, electrical engineer, shows that during the past year a net profit of £1,779 has been earned, as against the previous year's profit of £2,027, but the difference in the price of coal more than accounts for the reduction in the net profit. The gross profit was £6,381, equivalent to a return of 6·3 per cent. on the capital invested at the end of the year; £2,521 of this sum was required to meet the interest charges, and £2,083 went towards the sinking fund. Of the surplus of £1,779, as much as £1,500 was devoted in aid of the rates.

Stafford.—Last Friday Alderman Wright intimated to the Council that the supply of electricity during the month had increased 376 per cent. as compared with the corresponding month of last year.

Swindon.—Last week Col. J. T. Marsh, R.E., held a Local Government Board inquiry respecting an application made by the Swindon New Town District Council for power to borrow the sum of £3,100 for the purchase of Eastcott farmhouse and buildings, where it is proposed to erect an electric light and traction station.

The Board of Trade and Provisional Orders.—In the House of Commons on 12th inst., Mr. Lough asked the President of the Board of Trade whether he would explain why the Board of Trade insist on all transfers of electric lighting orders to companies being in a standard form, and refuse to allow variations required by local conditions; also on what grounds they refuse to allow the insertion of agreed provisions for the reduction of the maximum price either for public or private lighting; and whether he would consider the desirability of relaxing these departmental rules. Mr. Hanbury, replying for Mr. Ritchie, said that the Board of Trade do not consider that deeds of transfer under electric lighting orders should contain any provisions other than those which are consequential on the substitution of a company for a local authority as undertakers. To go beyond this is to provide under the colour of a mere deed of transfer for matters which really require the approval of Parliament. Transferees are placed in exactly the same position with regard to price as they would have been had they obtained an order originally. The price for a public supply is left to agreement, or, failing agreement, to arbitration. The price for a private supply is not specifically fixed, but is left as in the order, subject to a maximum which may be revised periodically by the Board of Trade on the representation of the local authority. He saw no reason for altering the existing practice.

West Bromwich.—The foundation stone of the Corporation electricity works, which are to cost about £30,000, was laid on Monday by the Mayor. The works are situate on the main road at Black Lake.

Western Valleys (Monmouthshire).—A suggestion has been made by the Abercarn District Council for a conference of all the Western Valley Councils to consider the advisability of a joint scheme for lighting the Valley with electricity. The matter appears to be taken up with energy, and deputations from the Councils concerned will probably attend the Conference when arranged.

ELECTRIC TRACTION NOTES.

Bath.—The Council has given conditional assent to the company electric tramway scheme. A committee recommended, and the Council has adopted its recommendation that macadam up to the rails would suffice, subject to the promise to lay wood pavement down if required by the Council from two years after construction. £100 per mile is the sum arranged for the maintenance and repair of the roads paved with wood, to commence from the opening of the tramway.

Bermondsey.—The clerk reported at a meeting of the Vestry that a letter had been received from the London County Council announcing the intention of the Council to apply in the next session for powers to construct tramways for a conduit system of electric traction along the new Tower Bridge southern approach now in course of construction.

Buenos Ayres.—The chairman of the Buenos Ayres Grand National Tramways Company, Limited, says that he and his colleagues on the board are strongly opposed to any change from the existing system (horse traction) to electric traction. In course of time it might be proved that electric traction in Buenos Ayres was the right thing, but he had grave doubts about that. The heavy cost of repairs and of coal in Buenos Ayres must make it very difficult for electric traction to compete with "the extraordinarily cheap" horse traction that they had there. The gross receipts per mile run for the past year were 7·64d., and the expenses 5·87d.

Cradley Heath.—The Board of Trade inspection of this line took place on 14th inst. A trial run was made last week.

Dundee.—The Board of Trade inspection of the electric tramways on the Perth Road route took place on 12th inst. The system was to commence regular running the following day.

Eastbourne.—An electric tram scheme is on foot for a line to start from Willingdon Railway Station, or from Polegate or Berwick for the conveyance of passengers to Beachy Head and Birling, where there is a good deal of suitable building land. There has been considerable opposition to tramways here, but it is hoped that the eyes of the inhabitants will be opened to the advantages to be gained by a good tram service in so famous a holiday resort.

Gosport.—At the last meeting of the District Council a letter was read from Mr. A. W. White, J.P., manager of the local tramways, stating that under the legal interpretation of the purchase clause of the Act, it was impossible to obtain money for the extension or improvement of any kind of tramways constructed under that statute, and thus wherever it applied matters must remain as they had during the last 10 years—in a state of stagnation. Mr. White continued:—

> No company would think of extending or expending any money upon a horse tramway in fac. of the advance now being made in electric traction, and to convert the Gosport tramways for electric traction and make the necessary extensions would probably cost from £30,000 to £40,000, and I suggest that your Council should decide whether they intend to acquire the tramways and work them as a corporate undertaking; and, if not, whether they would be prepared to enter into an undertaking with the company to promote a Bill in Parliament for the conversion and extension of the tramways upon a basis which would to some extent justify the company in the risk of the outlay. If such a course is adopted, I see no reason why Gosport should no. have the advantages of electric traction concurrently with Portsmouth.

The letter was referred to the Roads and Works Committee.

Moss Side.—At a meeting of the Moss Side (Manchester) Urban District Council it was decided to make application to the Local Government Board for sanction to a loan of £12,000 for relaying the tramlines in the district, so as to make them suitable for electric haulage, and a further sum of £3,000 for repairing the sides of the rails.

Paris.—The *Financial Times* remarks that it would appear that almost as much time will be occupied in the construction of the Metropolitan Electric Railway in Paris as has been

devoted for several years to the definite elaboration of the scheme. Of the total length of 42 kilometres the first section of 14 kilometres was expected to be opened for traffic on the occasion of the national fête just celebrated. The railway, which is being constructed on behalf of the Paris Municipal Council, is being equipped and will be worked by a company, but both parties are experiencing delay in the delivery of the constructional materials on the one hand, and rolling stock and generating plant on the other, thus allowing the company only to provide a limited service for the completed portion of the railway, upon which 22,000,000 francs has already been expended. The work of constructing the remaining 28 kilometres of line has not yet been commenced, and as the necessary money has still to be provided and voted by the Municipal Council, it is probable that a year or so will elapse before the building of the outstanding mileage is put in hand.

Rhyl.—It is understood that the contracts for the electric light works have been signed and sealed, but a letter has been received by the town clerk from the Rhyl and Prestatyn Light Railway Company relative to the proposed extension of the electric tramway through Rhyl. In the letter it is stated that the necessary notices have been issued, and that every effort is being made to hold the inquiry at an early date, in order that the scheme can be completed and in working order by April 1st, 1901.

Southampton.—The engineer having pointed out that the quay crane feeders must be overhauled and insulated before the Harbour Board can be supplied from the tramway system, the Town Council have adopted his recommendation that he be allowed to expend the whole or a portion of £500, which was set aside for this purpose, as he may think necessary.

Swansea.—The Corporation is engaging the necessary expert witnesses to appear in favour of the application to the Light Railway Commissioners for power to construct tramlines in the borough, as the Tramways Company is opposing the application.

TELEGRAPH AND TELEPHONE NOTES.

Aberdeen Telephones.—The Council has been considering whether to grant the National Telephone Company wayleaves for laying underground wires. The Finance Committee is going into the matter.

Brighton Telephones.—The Hove Town Council has referred to the Legal and Parliamentary Committee the subject of the municipal telephones, raised by the Brighton Town Council in a letter asking the Council to consent to their application to the Postmaster-General for permission to establish a system of public telephone communication. The committee has been authorised to confer with any applicants and obtain expert advice or assistance if thought desirable.

Chinese Telegraphs.—In reply to Sir Charles Dilke in the Commons on Tuesday, the Chancellor of the Exchequer said that the proposed cable to Wei-hai-Wei is not to be laid from Gutzlaff but from the Saddle Islands, which are some 30 miles further seawards. The Great Northern Company has no station on these islands. Arrangements will be made for the working of the cable by a British staff. Negotiations are in progress with the Eastern Extension Telegraph Company as to the ownership of the cable. Pending the result the company will lay and work the line.

The *Times* Shanghai correspondent telegraphs on 12th inst. that telegraphic communication with Chifu was interrupted. The line was damaged at a station between Chifu and Wei-hsien, the point whence the branch line runs to Kiao-chau. The administration is sending a repairing party from Chifu.

Dover Telephones.—Last week the Council had before it the report on a municipal telephone exchange, and after some discussion adjourned the approval *sine die*. It was recognised that the municipality was not in a position to do the work, and, furthermore, they would have no connection with other towns if they did. Alderman Pepper thought the dissatisfaction with telephone employés would be increased tenfold if they had their own service. They ought to be content with what they were doing, instead of rushing into all sorts of trading capacities for which the municipality was not meant.

Indian Telegraph Tariff.—Last week Lord G. Hamilton said in the House of Commons that he could not as yet state when the proposed reduction in the telegraph rate to India will take place. The consent of various parties has to be obtained, and for this time is required; but I am not aware that any difficulty has arisen in the negotiations.

Manchester.—At a meeting of the Telephones Committee of the Corporation on Tuesday, a letter which had been received from the manager of the National Telephone Company, in reply to the suggestions made by members of the committee that the company should sell their plant in the Manchester telephone area to the Corporation, was read. The reply was virtually a negative, but a counter proposal made on behalf of the company will form the subject of an interview.

The Pacific Cable.—In the House of Commons on Tuesday, 12th inst., Sir E. Sassoon (Hythe) asked the Secretary of State for the Colonies whether the Pacific cable board had now definitely decided to commence the laying of their cable. Mr. Chamberlain, in reply, said, "The various Governments interested have accepted the recommendations of the Pacific Cable Committee, and tenders for the establishment of the cable will be called for immediately."

Following this announcement came the advertisement inviting tenders for the manufacture and laying of the 8,272 nautical miles of cable. The advertisement appeared in Friday's papers, and is given under "Contracts Open" this week.

Siberian Telegraphs.—Reuter's agent at St. Petersburg stated on 12th inst.:—

It is officially announced that traffic on the Great Siberian Telegraph line has lately been interrupted owing to daily thunderstorms and to damage caused by gales and forest fires in the Trans-Baikal territory. Moreover, the unusually large number of messages sent on account of events in China impedes the rapid transmission of telegrams, which accordingly suffer a delay of several days.

Sunderland Telephones.—A deputation from the Sunderland Town Council waited upon the Postmaster-General, Lord Londonderry, in London, on 15th inst., with reference to municipal telephones. Lord Londonderry expressed the view that encouragement and facilities ought to be given to municipalities to develop in this direction, and promised to give favourable consideration to any application for a license to the Corporation.

Telegraphic Interruptions and Repairs:—

Cables.	Interrupted.	Repaired
South American:—		
Cayenne-Pinheiro	Oct. 11, 1899	
Cayenne-Paramaribo	Feb. 16, 1900	
Pará-Maranham	March 1, 1900	
Ceará-Maranham	Feb. 20, 1900	
West Indies:—		
Jamaica-Colon	June 30, 1899	
Mole St. Nicholas-Cape Haitien	March 6, 1900	
Latakia-Cyprus	June 20, 1900	
Tarifa-Tangier	Jan. 3, 1900	
Landlines:—		
Chinese:—		
Tientsin-Pekin	June 12, 1900	
Pekin-Kalgan	June 14, 1900	
Kalgan-Maimatchin	June 30, 1900	
Tientsin, *via* Shanghai	June 16, 1900	
Tientsin-Niuchwang	June 18, 1900	
Shanghai-Chefoo	July 11, 1900	July 13, 1900
South American:—		
Communications with all offices of Columbia beyond Buenaventura	January 22, 1900	
Ecuador landlines	March 13, 1897	
Landlines south of Macahé (Brazil)	April 25, 1900	
Communication "*via* Hanekine" interrupted on Persian territory	Feb. 24. 1900	
Saigon-Bangkok	July 13, 1900	July 15, 1900

Wireless Telegraphy and Lighthouses.—Speaking in reply to Sir J. Colomb in the House of Commons on 13th inst., Mr. Ritchie said that he understood that the experiment of establishing electrical communication with the East Goodwin light vessel was regarded as successful. The experiment having been completed the apparatus was removed, and the whole question of electrical communication with light stations has been referred to an inter-departmental committee. He was not aware of the name of the receiving office in Germany with which the Borkum light vessel is in communication, and was, therefore, unable to state the distance between the office and the vessel. The distance between the East Goodwin light vessel and the receiving office in England was about 10 miles. The mere practicability of establishing communication was not the only question to be considered. Very difficult questions of patent rights were involved, and the question how to deal with those rights needs careful handling. He had communicated to the inter-departmental committee expressing the hope that they may speedily make their report. The Post Office, the Treasury, the Admiralty, and the Board of Trade were all represented on the committee.

CONTRACTS OPEN AND CLOSED.

OPEN.

Aarhus, Denmark.—The municipal electrical works are wanting "200 pieces electro-meters." For particulars see "Official Notices" to-day.

Aston Manor.—July 24th. The Council wants tenders for steam dynamo, motors, switchboard, pipe work, battery, pumps, arc lamps and posts, crane and wiring. See "Official Notices" July 13th.

Blackpool.—July 23rd. The Corporation wants tenders for trolley poles, cables and trolley wire, boosters and switchboards, and storage battery. See "Official Notices" June 22nd.

Brussels.—September 19th. The Council of St. Jilles, lez Bruxelles, invites tenders for the installation and the commencement of supply upon a part of its territory. Conditions and plan for three francs at the office, No. 14, Parvis St. Jillies, St. Jilles.

Cardiff.—July 24th. The Corporation wants tenders for 10 30-kw. transformers. See "Official Notes" July 13th.

Darlington.—July 28th. The Corporation wants tenders for arc lamp-posts and brackets. See "Official Notices" July 13th.

Dorking.—The District Council are open to receive offers for leasing their provisional order. See "Official Notices" to-day.

Durban.—July 20th. The Corporation wants tenders for overhead equipment for (*a*) about 16 miles of single track, including poles, overhead trolley wire, distribution boxes; (*b*) 22 double-deck motor cars; (*c*) steam and electric generating plant, including three 250-kw. generators, boilers, condensers, cooling towers, switchboard, &c. See "Official Notices" May 18 and June 15th.

Germany.—July 25th. Tenders are being invited until July 15th by the Baden State Railway authorities at Carlsruhe for the supply of two large multiphase alternators required for a central station they are establishing at Mannheim. Tenders are to be sent to Die General Direction der Grossl Badische Staatseisenbadnen Carlsruhe, where particulars may be obtained for 3s.

Germany.—July 28th. Tenders are being invited until the 28th inst. by the State river authorities at Emden for the supply and erection of three 1½-ton electric wall cranes, and a 40-ton electric swing crane. Tenders to be sent to Die Königliche Wasserbaninsfertion, Emden, Germany, whence particulars may be obtained for 2s.

Glasgow.—July 26th. The Corporation wants tenders for the supply of concentric and single main cables. See "Official Notices" to-day.

Grays Thurrock.—August 9th. The Council is inviting tenders for Lancashire boilers, 100-kw. steam dynamos, economisers, switchboards, battery, crane, mains, and other plant, &c. See "Official Notices" June 29th.

Grimsby.—August 8th. The Corporation wants tenders for wiring the electricity works. See "Official Notices" to-day.

Halifax.—July 31st. The Corporation wants tenders for a steam engine and alternator, alternators, static transformers, induction motors, rotary converters, and three-phase extra high tension switchboard. See "Official Notices" July 13th.

Hull.—July 23rd. The Corporation wants tenders for the electric lighting installations and fittings for the Springhead pumping station. See "Official Notices" July 13th.

Hull.—July 26th. The Electric Lighting Committee wants tenders for five high tension continuous current rotatory transformers with switch gear and accessories. See "Official Notices" July 13th.

Islington.—July 25th. The Vestry wants tenders for relaying York and other stone over electric conduits and mains. See "Official Notices" July 6th.

Madrid.—August 18th. Tenders are invited by the Spanish Government, not later than August 18th, for the concession of a system of electric tramway lines in Barcelona. Some particulars may be examined at the commercial department of the Foreign Office between 11 a.m. and 5 p.m.

Manchester.—July 21st. The Tramways Committee wants tenders for the electrical equipment of 150 cars. See "Official Notices" July 13th.

Russia.—August 28th. The General Direction of the Russian Posts and Telegraphs in St. Petersburg are inviting tenders until August 28th for the concession for the working during a period of 68 years of the telephone exchanges in St. Petersburg, Warsaw, Riga, Moscow, and Odessa.

Salford.—August 13th. The Corporation wants tenders for lighting cables, tramway feeders, and street lighting. See "Official Notices" July 13th.

Sheffield.—July 21st. The Corporation wants tenders for 12 months supply of transformers. See "Official Notices" July 13th.

Southend-on-Sea.—July 25th. The Corporation is inviting tenders for (*a*) boilers and auxiliaries; (*b*) steam generators, and switchboards and crane; (*c*) feeders and distributors; (*d*) line equipment; (*e*) trucks and car equipments. Specifications, &c., from Mr. Alfred Fidler, A.M.I.C.E., borough engineer. Deposit three guineas.

Spain.—July 21st. The municipal authorities of Algemesi (Province of Valencia) are inviting tenders until July 21st for the concession for the electric lighting of the town during a period of 10 years. Particulars are to be obtained from, and tenders to be sent to, El Secretario del Ayuntanicente de Algemesi (Valencia).

Stockport.—August 31st. The Tramways Committee wants tenders for 20 double-deck tramcars with electrical equipments. See "Official Notices" July 13th.

Sunderland.—July 27th. The Corporation wants tenders for a coal conveying plant for the electrical supply station. See "Official Notices" July 13th.

The Pacific Cable.—August 14th. Tenders for the manufacture and laying in the Pacific Ocean of 8,272 nautical miles of telegraph cable between

Vancouver and Fanning Island,
Fanning Island and Fiji,
Fiji and Norfolk Island,
Norfolk Island and New Zealand,
Norfolk Island and Queensland,

are invited by the Pacific Cable Committee on behalf of Her Majesty's Government and the Governments of Canada, New South Wales, Victoria, New Zealand, and Queensland.

It is proposed to divide the whole undertaking under three distinct contracts, for any one or more of which contractors may tender.

Each of these contracts will include a clause under which the contractor guarantees the good electrical condition and working order of the cables for 30 consecutive days after the completion of the laying.

A fourth contract is also proposed for surveying and sounding the whole route before the cables are laid.

Forms of contract, specification, and tender may be obtained on and after the 17th inst. of Messrs. Clark, Forde & Taylor, 4, Great Winchester Street, E.C., at whose offices charts, showing the proposed route of the cables and the positions where soundings are to be taken, may be inspected.

The last day for the reception of tenders is Tuesday, the 14th proximo.

They must be enclosed in sealed covers marked "Tender for Pacific Cable," must be addressed to Messrs. Clark, Forde & Taylor, 4, Great Winchester Street, E.C., and delivered by 12 o'clock noon on that day.

The lowest (or any) tender will not necessarily be accepted.

Torquay.—August 6th. Tenders are wanted by the Corporation for two water-tube boilers with superheaters, two inductor alternators with Willans engines, pipework, surface condenser, extensions to high tension switchboards, wattmeters, &c., and transformers. See "Official Notices" to-day.

Warsaw.—August 28th. The Secretary of State for Foreign Affairs has received a despatch from Her Majesty's Acting Consul-General at Warsaw stating that tenders are invited by the Russian Government, not later than the 28th prox., for the telephone service of Warsaw, St. Petersburg, Moscow, Odessa, and Riga Some particulars may be examined at the Commercial Department of the Foreign Office between 11 a.m. and 5 p.m.

CLOSED.

France.—On the 15th inst. the French Post and Telegraph authorities opened tenders for the supply of 135 tons of galvanized iron wire, 4 mm. diameter. The contract was secured by Messrs. Lazare, Weiler & Co., of Paris.

Glasgow.—The Corporation has accepted tenders as follows:—Switchboards for Port Dundas electricity station, Mechan and Son, £1,122; carbons for 12 months, International Electric Company and General Electric Company.

London.—The Shoreditch Vestry on Tuesday considered the undernoted tenders for the supply of additional boilers for the electric light station:—

1.—Dryback Boilers.

	4 boilers.	8 boilers.
Danks & Co.	£5,500	£11,005
Fraser & Co.	5,889	11,579
Add for work not included in tender, say	250	500
Hodge & Son	6,250	12,300
Davey Paxman & Co. (10 boilers)	—	14,100
Add for stol erge r, say	—	700
D. Stewart & Co.	7,705	15,345
Fleming & Fergusson	9,000	17,500

2.—Water-Tube Boilers.

	4 boilers.	8 boilers.
Stirling Boiler Company	£4,488	£8,490
Babcock & Wilcox (land type)	5,500	11,000
Danks & Co.	—	11,005
Rowland & Co.	5,655	11,145
Babcock & Wilcox (marine type) (accepted)	5,600	11,200
Renshaw & Co.	6,248	11,996
D. Stewart & Co.	7,097	14,097

The accepted tender is for four boilers for £5,600, and the tender of the same company was also accepted for the supply of the economisers for the boilers at the price of £220 per boiler.

Lynn.—The Council has contracted with Bardell Bros. for extension of the electricity works buildings at a cost of £1,178.

Plymouth.—The lowest tender received for the erection of the electricity sub-station at Armada Street (£1,858) being considerably in excess of the estimate (£700) upon which the application for loan was made, the matter has been deferred.

Stafford.—The Council on Friday accepted the tender of the Chloride Electrical Storage Syndicate, Limited, amounting to £1,699, for battery, switchboard, &c. The tenders of the Electric Construction Company (£287) for rewinding and converting the dynamos so as to double the present pressure, and of Messrs. Willans and Robinson for a 350-h.p. engine, at a cost of £1,400, were accepted.

Thorp Perrow, Yorkshire.—The following is a list of tenders received for electric light installation at Thorp Perrow, Yorkshire, for H. C. Allfrey, Esq. Consulting engineer, Mr. Morgan Williams, C.E., 39, Victoria Street, Westminster, S.W.

Messrs. J. C. Holmes & Co., Newcastle	£2,575
Messrs. Ernest Scott & Mountain, Newcastle	2,501
Messrs. Cox-Walkers, Darlington (1)	2,400
(2)	2,280
Messrs. Bland Bros., Newcastle	2,980
Messrs. Walker & Hutton, Scarborough	2,250
Messrs. Mavor & Coulson, Glasgow (1)	2,051
(2)	2,030
(3) accepted	1,995

FORTHCOMING EVENT.

Friday, July 27th.—6.30 p.m. Institution of Junior Engineers' visit to the generating station and depôt of the Central London Railway, Shepherd's Bush.

NEW COMPANIES REGISTERED.

Brockie-Pell Arc Lamp, Limited (66,602).—This company was registered on July 12th, with a capital of £80,000 in £1 shares, to adopt an agreement with the Brockie-Pell Arc Lamp, Limited (registered in 1896) and to carry on the business of manufacturers of and dealers in electric arc lamps, electric incandescent lamps, and electrical appliances, and the business of an electric lighting company in all its branches. The first subscribers (each with one share) are:—H. W. Brown, 59, Mackenzie Road, Beckenham, journalist; E. T. Church, 2, Keplar Road, S.W., clerk; J. W. Honess, 35, Florence Road, S.W., secretary; H. Paul, 14, Brailsford Road, S.W., gentleman; J. A. Fuller, 50, Chatterton Road, N., clerk; E. S. Harper, 3, Shawbury Road, S.E., clerk; and A. D. Brown, 31, Reighton Road, N.E., writer. The number of directors is not to be less than three nor more than seven; the subscribers are to appoint the first; qualification, £200; remuneration, £450 per annum, and a share in the profits (maximum £2,000), divisible.

John Davis & Son (Derby), Limited (66,606).—This company was registered on July 13th, with a capital of £35,000 in £1 shares, to acquire the business now carried on at All Saints' Works, Derby, as "John Davis & Son," and to carry on the business of consulting and general engineers, manufacturers of mining, engineering, electrical and scientific apparatus, miners' safety lamp manufacturers, patentees, machinists, tube makers, wire drawers, metal workers, rollers, enamellers, tool makers, manufacturers of electrical and other carriages, motors and accessories, suppliers of electricity, &c. The first subscribers (each with one share) are:—H. Davis, All Saints' Works, Derby, engineer; L. W. de Grave, Charnwood Street, Derby, engineer; C. P. Stephenson, The Knoll, Duffield, stockbroker; M. Attwood, Westleigh, Derby, solicitor; W. H. Evans, 69, Stanley Street, Derby, electrical engineer; and J. J. Barnett, 31, Walter Street, Derby, instrument maker. The number of directors is not to be less than three nor more than seven. The first are Henry Davis (governing director), Lancelot W. de Grave, Matthew Attwood and Charles P. Stevenson; remuneration as fixed by the company. Registered office, All Saints' Works, Amen Alley, Derby.

J. G. White & Co., Limited (66,568).—This company was registered on July 10th, with a capital of £100,000 in 5,000 preference shares of £10 each and 50,000 ordinary shares of £1 each, to adopt an agreement with J. G. White & Co. (incorporated under the laws of New York), and to carry on the business of railway, tramway, telegraph, and electrical works proprietors, electricians, engineers, contractors, promoters, &c. The first subscribers are:—J. G. White, Savoy Hotel, W.C., electrical engineer, with 500 shares; A. H. P. Stoneham, 29, St. Swithin's Lane, E.C., chartered accountant, with 100 shares; P. H. Baldwin, 5, Norfolk Street, W.C., engineer, with 100 shares; E. B. Wyman, Wariney, Ditton Hill, Surrey, with 100 shares; W. C. Burton, 22A, College Hill, E.C., with 100 shares; C. Wren, 31, St. Swithin's Lane, E.C., managing director, with 100 shares; and A. N. Connett, 10, Rue de Londres, Paris, civil engineer, with 100 shares. The number of directors is not to be less than three nor more than nine; the subscribers are to appoint the first; qualification, £250; remuneration, £10 each per annum and a share in the profits.

Taylor, Tunnicliff & Co. (1,900), Limited (65,544).—This company was registered on July 9th, with a capital of £100,000 in £1 shares (400,000 preference), to acquire the assets and liabilities of Taylor, Tunnicliff & Co., Limited (incorporated in 1896), to adopt an agreement with the said old company, and to carry on the business of potters, china, stoneware and earthenware manufacturers, colour grinders, manufacturers of appliances for electrical work, &c. The first subscribers (each with one share) are:—Thomas Taylor, Rosendale, Newcastle, Staffordshire, manufacturer; Joseph Grocott, 5, Birch Terrace, Hanley, manager; Frederick Mountford, 17, Havelock Place, Hanley, secretary; Francis H. Pepper, 34, Waterloo Street, Birmingham, solicitor; Arthur L. Tangye, 38, Old Jewry, E.C., solicitor; Herbert R. Winterton, 34, Waterloo Street, Birmingham, solicitor; and John W. Harvey, 28, Algernon Road, Birmingham, accountant. The number of directors is not to be less than three nor more than seven; the subscribers are to appoint the first; qualification, 100 shares. Registered office, Eastwood, Hanley, Staffordshire.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Reuter's Telegram Company, Limited (1,909 C).—This company's annual return was filed on June 15th, when 11,839 shares were taken up out of a nominal capital of £100,000 in £8 shares. £8 has been called up on each share, resulting in the receipt of £94,712.

Wycombe (Borough) Electric Light and Power Company, Limited (53,133).—This company's annual return was filed on May 11th, when 2,020 shares were taken up out of a nominal capital of £30,000 in £5 shares. £5 has been called up on each share, resulting in the receipt of £10,100.

West India and Panama Telegraph Company, Limited (11,116).—This company's annual return was filed on June 26th, when 88,321 ordinary, 34,563 first preference, and 4,669 second preference shares were taken up out of a nominal capital of £2,445,630 in 200,000 ordinary, 34,563 first preference, and 10,000 second preference shares of £10 each; £10 per share has been called up, resulting in the receipt of £1,275,530.

Electric Traction Company, Limited (40,798).—This company's annual return was filed on May 22nd, when the entire capital of £300,000 in 1,200 £1 shares and 29,880 £10 shares had been taken up and paid for in full.

NOTES.

Personal.—The British Electric Traction Company, Limited, sends us the following notification of recent staff changes:—

Mr. James Devonshire, having been appointed a member of the Committee for Associated Undertakings, has vacated the position of district superintendent for London and South-Eastern District.

Mr. Daniel F. Sugrue has vacated the position of district superintendent for the Eastern Counties District, and will undertake certain supervisory duties for the management.

Mr. George Stevens has resigned the position of secretary, and has been appointed chief district superintendent with charge of the London and South-Eastern Counties Districts.

Mr. Charles H. Dade has been appointed secretary of the company.

Mr. Ernest Hopwood has been appointed districts secretary.

Mr. M'Allister Hanley has been appointed assistant electrical engineer at the Greenock electricity works.

Mr. W. G. Rhodes, M.Sc., M.I.E.E., has resigned his position as chief lecturer in electrical engineering at the Royal Technical Institute, Salford, to join Mr. J. M. Hewitt, formerly manager of Messrs. Mather & Platt, Limited, and now conducting business as consulting, mechanical and electrical engineer at Tower Chambers, Brown Street, Manchester. In future this business will be carried on at the same address under the name of Hewitt & Rhodes.

Mr. Joseph Wilkinson has been appointed assistant engineer to the Hull Corporation in place of Mr. Andrews, B.Sc., who has now taken up duties as chief engineering assistant of the Sunderland Tramways.

Light Railways.—The *Times* states that the following dates have been provisionally proposed for the holding of local inquiries by the Light Railway Commissioners. Due notice, by advertisement and otherwise, will be given in the usual way when any date is finally arranged:—July 23rd, Kingston, Surbiton, and District Light Railway, 1899, extension, 1900; 24th, Hayling Island; 26th, Norwich and Dereham; 30th, Bath and district; 31st, Bridgwater, Stowey, and Stogursey. August 1st, Devon South Hams; 3rd, Mid-Anglian, 1899, Mid-Anglian (amending), 1900. September 20th, Rhyl and Prestatyn (extension); 21st, Pwllheli and Nevin; 22nd, Warrington and Runcorn; 24th, Windermere and district; 25th, Blackburn, Whalley, and Burnley; 26th, Wigan; 7th, Hyde and Dukinfield. October 8th, Deanhead; 9th, Nidd Valley; 10th, Durham and district, West Hartlepool (extensions), 1899; 11th, Jarrow and South Shields; 12th, Wales and Laughton, Barnsley and district (extension No. 2); 17th, Kidderminster and Bewdley; 18th, Cleobury Mortimer, and Ditton Priors; 25th, Swansea and district; 26th, Llanelly and district; and 27th, Rhondda Valley.

(*Continued on page* 107.)

SOUTHAMPTON CORPORATION ELECTRIC TRAMWAYS.

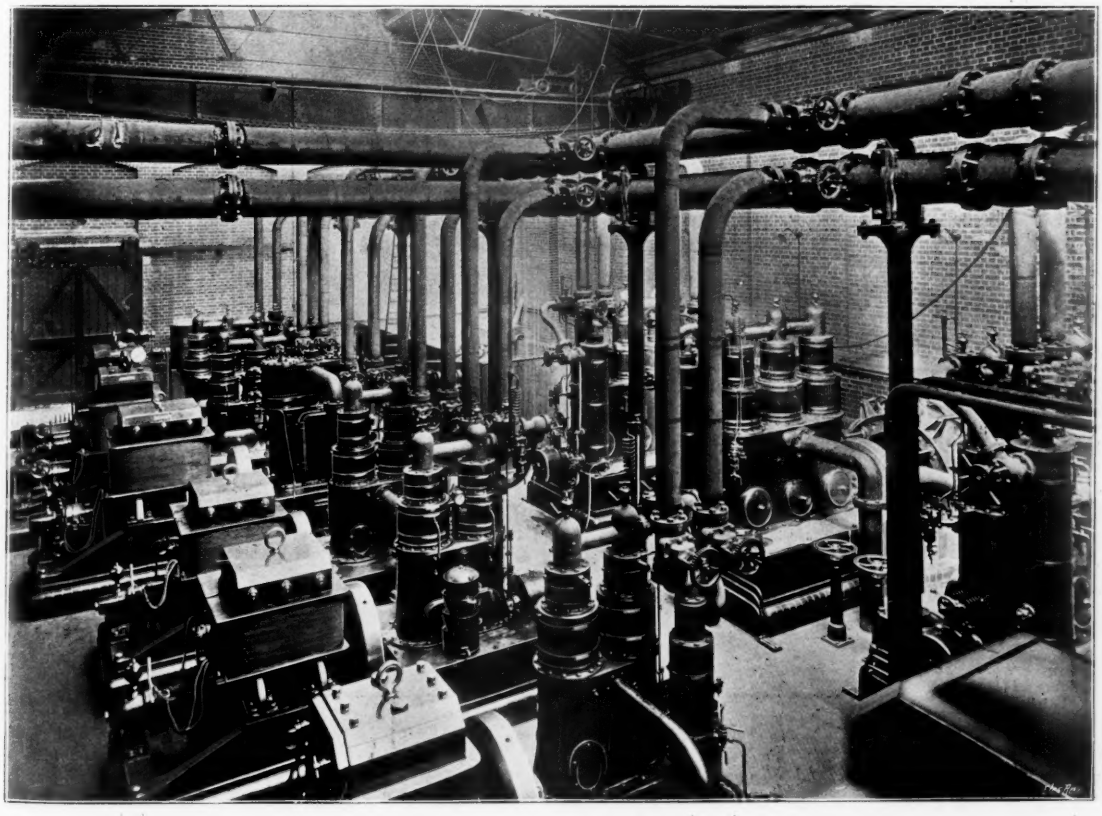
The Corporation acquired in 1898 the undertaking then belonging to the Southampton Tramways Company, who owned the whole of the tramways in the borough, which were operated by horse traction; as soon as the Corporation obtained possession the work of reconstruction and conversion to the overhead system of electric traction was taken in hand.

The tramways consist of the following routes:—Prospect Place to Shirley, $1\frac{3}{4}$ miles; Prospect Place to South-Western Hotel, $1\frac{1}{4}$ miles; Prospect Place to Portswood, $1\frac{3}{4}$ miles.

The first of the above routes was reconstructed and opened for electrical working at the beginning of this year; since then the second and third routes have also been completed and opened for traffic.

View of Prospect Place.

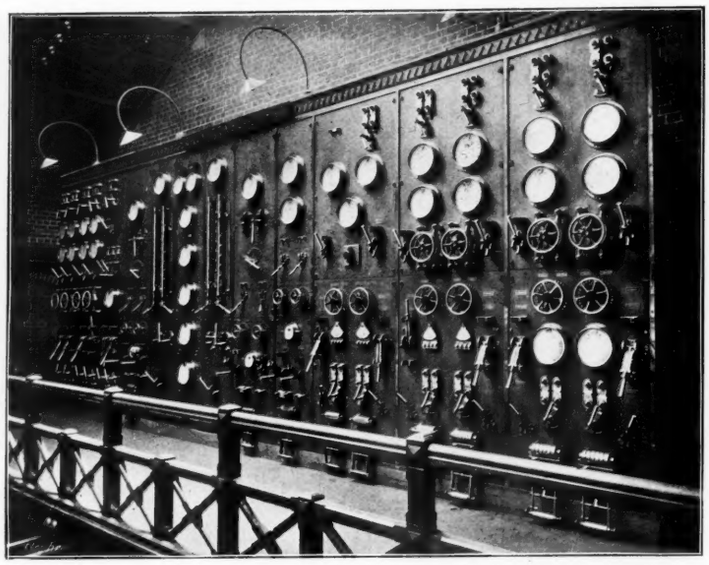
Power for working the tramways is obtained from the existing plant in the station, which has hitherto been used for supplying the lighting only. Steam is supplied by means of six Babcock & Wilcox water-tube boilers, and one Lancashire boiler, which are fitted with Vicars stokers, except in the case of two which have lately been equipped with the Babcock-Wilcox stoker. The hoppers of the stokers are supplied with fuel by means of a coal elevator and conveyor, which brings the coal (small slack) from the adjoining coal store. The whole of the coal-handling gear is driven by one of Messrs. J. H. Holmes & Co.'s 9 H.P. Lundell motors, with worm gear. A similar motor is used to drive a three-throw feed pump; there are two other similar pumps, driven by steam engines, and all three were made by Messrs. Hayward, Tyler & Co. The feed pipes are in duplicate, and are arranged so as to pass the feed water, either through the Green's economiser or direct to the boilers as desired. The steam piping is arranged in duplicate, two main pipes being led from the boilers into the engine room, and there teed on two similar ranges running down the middle of the engine room.



General View of Engine Room.

F

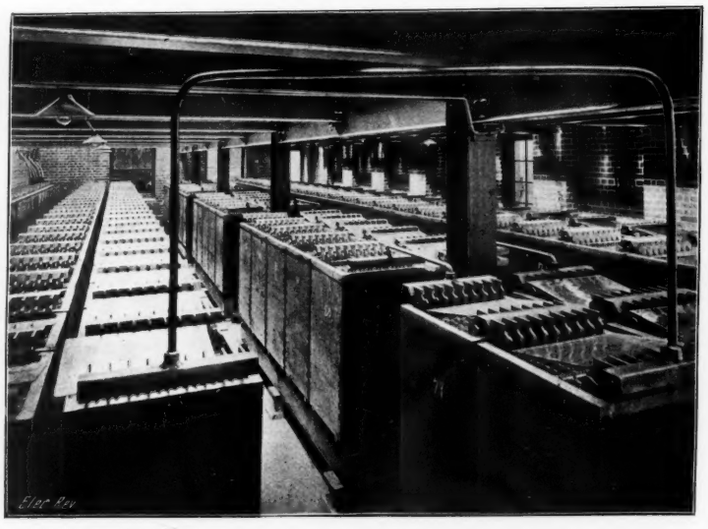
The generating plant, of which we give a view, consists of six shunt wound two-pole Crompton dynamos coupled direct to five Willans engines and one Belliss engine. They are of various sizes, the largest sets being of about 100 KW. capacity, and generating at 235 volts. When running on the traction load these machines are coupled in pairs in series, giving 470 volts; as the line pressure is 500 volts, the additional E.M.F. is provided by means of boosters, which are placed in the traction switchboard room. One of our illustrations shows the four boosters, two of which are for the purpose above mentioned, and the remaining two—the larger machines—for charging the battery.



Main Light and Power Switchboard.

The boosters are four-pole machines, made by Messrs. Bruce Peebles and Co., and each driven by a shunt-wound motor of similar type. The feeder boosters are compound wound, a rather unusual feature; this is due to the necessity of generating about 30 volts at no load; while at full load the booster E.M.F. is about 80 volts, giving 550 volts at the station. The machines are of neat and substantial construction, and run quite sparklessly, with carbon brushes.

The battery charging boosters are provided with double-wound armatures, each having two commutators; by putting these in parallel, by means of a switch at the side of the machine, a large current capacity is obtained at low voltage without unduly weakening the fields, while for higher pressures they are coupled in series. These boosters, besides charging the battery, can be used to assist the latter in case of need when discharging; they are also available as feeder boosters if required.



Part of the Traction Battery.

A large battery of accumulators of the Tudor type has been installed to relieve the generators when they are required for lighting during the hours of heaviest load; part of this battery forms the subject of one of our views. There are 236 cells, of 1,900 ampere-hours capacity, when discharged for five hours at 380 amperes. The maximum discharge rate is 570 amperes, and the normal charging rate 320 amperes. When fully charged the battery is capable of supplying power to 20 motor cars for four hours, and can therefore take the entire traction load for that period. It is normally connected through the booster with the line when the generators are running, and is found to act as an admirable regulator, the charging current varying according to the load, while the current from the generators remains fairly steady. The economical conditions of running obtained by this means are bound to have a salutary effect on the coal consumption, and it is a matter for surprise that the same course is not more frequently adopted; although the capital charges due to the battery are probably greater than those on the generating plant which would be necessary in the absence of storage, the saving in coal and wages more than makes up the difference, quite apart from the gain in reliability and convenience. The battery is housed in an three-storey building adjoining the booster room, and there is ample space for doubling the number of cells.

A 300 KW. steam dynamo is about to be installed, and will be provided with a double-wound armature, so that when it is used for lighting the two windings can be coupled in parallel, while for supplying the tramways they will be in series.

The traction switchboard, of which we give an illustration, is placed in the booster room, and is a handsome structure, made by Messrs. Fowler, Lancaster & Co., of Birmingham. It consists of six dynamo panels, one instrument panel, battery and booster panels, Board of Trade panel, and six feeder panels. The dynamo switches are two-throw, to enable any dynamo to be run in series with any other. The dynamo panels carry also shunt regulators, and British Thomson-Houston circuit breakers and watt-hour meters. The battery panel is fitted with a regulator in the end cells, circuit breaker, ammeter, and voltmeter, and booster throw-over and cut-out switches. The booster panels bear shunt regulators for motor and generator, starting switch and double-pole main switch. The Board of Trade panel is of Messrs. Elliot Bros.' usual pattern, and the feeder panels are fitted with circuit breakers, main switches, and ammeters. Pending the completion of the permanent plant, the first section of the tramways to be opened was supplied with power by a temporary generating set, consisting of a 100-KW. Westinghouse compound-wound generator, driven by belt by a Westinghouse vertical engine, erected in a corner of the engine room.

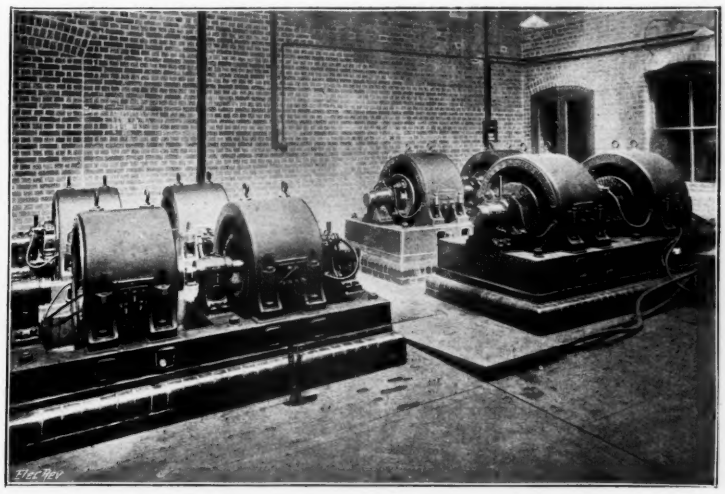
The feeders consist of insulated lead-covered cables, drawn into stoneware ducts by means of drawing-in boxes which are provided at suitable intervals, and connected up to switch

pillars. They vary in size from ·30 square inch to ·079 square inch.

A three-core pilot and telephone cable is drawn into ducts with the feeders and connected with each switch pillar, the test wires being continued to the ends of the lines for the purpose of recording the drop in pressure on the rail return on the recording voltmeter at the generating station.

The whole of the cables were supplied, drawn in and connected up by Messrs. W. T. Glover & Co., and the conduits and drawing-in boxes were put in by Mr. F. Osman, of Southampton.

The permanent way throughout consists of new girder rails, laid as double, single, and interlacing lines, to a 4 feet 8½ inches gauge, the following being the total length of each



Feeder and Battery-Charging Boosters.

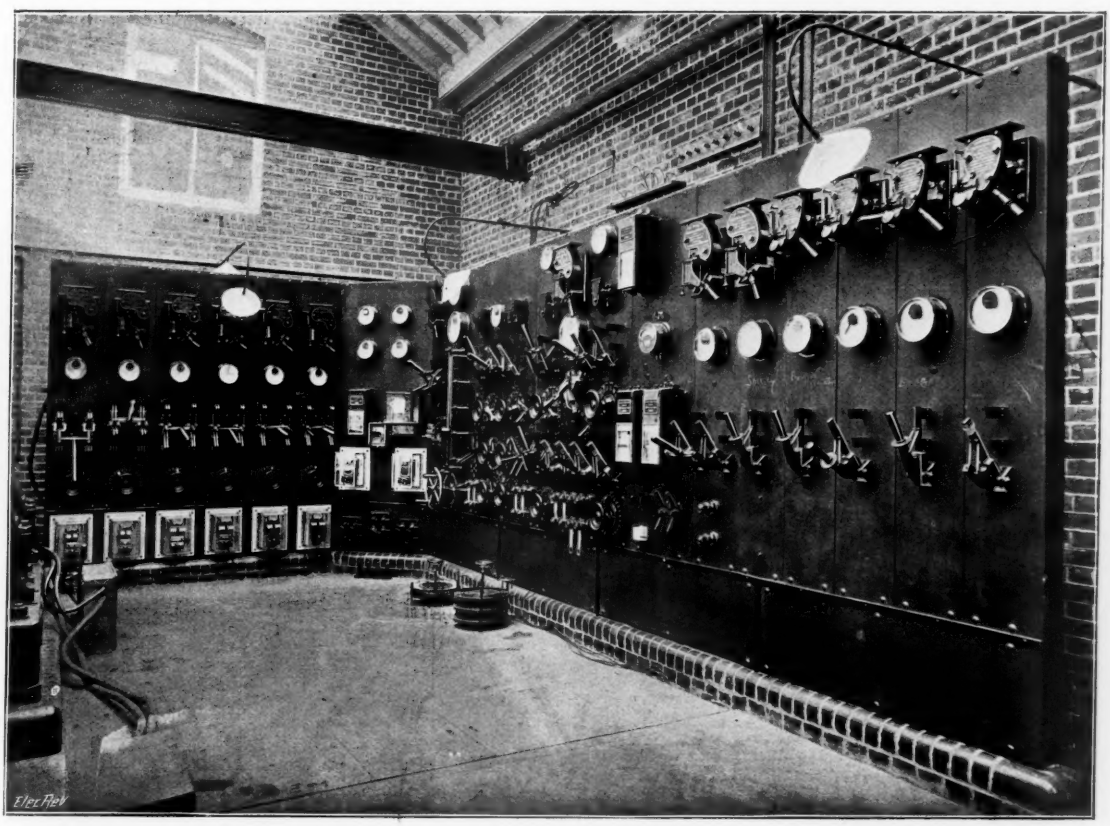
steel, and are bolted together with six 1-inch bolts at the joints. The tie bars are of ⅝-inch × 2½-inch steel, and average 2½ yards apart.

The points, mates, and crossings, which were supplied by Messrs. Askham Bros. & Wilson, are steel castings, with mild steel tongues.

The rails are laid on a bed of concrete 6 inches in thickness, consisting of six parts of broken stone to one of cement.

The joints between the rail lengths are all double bonded, with two No. 0000 Chicago rail bonds. Cross bonds are placed at intervals of 120 feet, and where double line occurs the lines are bonded together at intervals of 240 feet, similar bonds being used in each case.

The contractors for the road construction and laying of



Traction Switchboard.

form of construction:—Double line, 3½ miles; single line, 1 mile; interlacing lines, ¼ mile.

The rails are of steel, rolled in lengths of 45 feet, and weighing 86 lbs. per yard. They were supplied by the Leeds Steel Works Company. The fishplates are also of

track for the first section were Messrs. Krauss & Sons, of Bristol; the other sections were carried out by Mr. F. Osman, of Southampton.

The overhead construction consists of double trolley wire throughout, of 00 B. and S. gauge of hard drawn copper,

having a conductivity of 98 per cent. of pure copper, carried on steel poles with bracket arms.

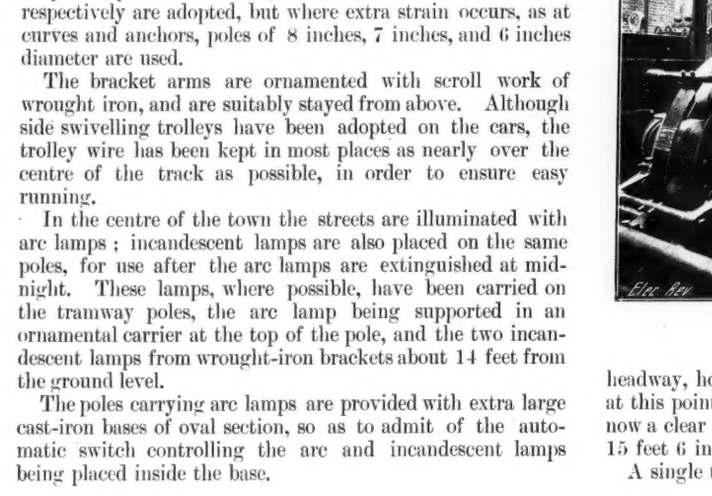
In places where the roadway is of sufficient width, and where double line occurs, the poles are placed in the centre of the road between the two tracks; elsewhere they are placed at the edge of the footpaths, and side bracket suspension adopted. Our view of Prospect Place shows the overhead work at an important junction.

The poles are of steel, made in three sections, with swaged joints between the sections, and are of two sizes; for ordinary use, poles of 7 inches, 6 inches, and 5 inches diameter respectively are adopted, but where extra strain occurs, as at curves and anchors, poles of 8 inches, 7 inches, and 6 inches diameter are used.

The bracket arms are ornamented with scroll work of wrought iron, and are suitably stayed from above. Although side swivelling trolleys have been adopted on the cars, the trolley wire has been kept in most places as nearly over the centre of the track as possible, in order to ensure easy running.

In the centre of the town the streets are illuminated with arc lamps; incandescent lamps are also placed on the same poles, for use after the arc lamps are extinguished at midnight. These lamps, where possible, have been carried on the tramway poles, the arc lamp being supported in an ornamental carrier at the top of the pole, and the two incandescent lamps from wrought-iron brackets about 14 feet from the ground level.

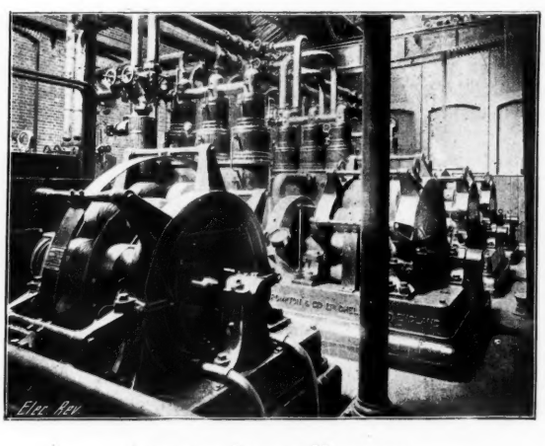
The poles carrying arc lamps are provided with extra large cast-iron bases of oval section, so as to admit of the automatic switch controlling the arc and incandescent lamps being placed inside the base.



The Bar Gate.

A special feature in connection with the overhead construction is the method which has been adopted in getting through the Bar Gate, a low and narrow archway through which the cars have to pass, and which is situated on the route from Prospect Place to the South-Western Hotel at the lower end of Above Bar; our illustration will give some idea of the difficulties presented by this somewhat inconvenient relic.

The archway is very ancient, and of considerable architectural interest, so that it was decided not to remove it; the headway, however, has been increased by lowering the road at this point by from 18 inches to 2 feet, so that there is now a clear height at the lowest part of the archway of about 15 feet 6 inches.



Alternate Current Machinery.

A single trolley wire has been carried right through the Bar Gate, but in order to prevent persons on the top of high wagons or other vehicles from making accidental contact with the wire, the section of trolley wire passing through the archway is insulated from the remainder of the system, and is only made alive when a car is passing through it.

The operation of switching on and off is performed automatically by means of a switch placed in the archway and controlled by an electro-magnet, the arrangement being such that when a car enters the section the switch closes, and on the car leaving it opens again. The opening and closing of the switch are so arranged as to take place at a time when no current is being taken from the section.

As is usual, the trolley wires throughout the system are divided up into sections averaging half a mile in length, by means of section insulators.

The sections are fed from switch pillars placed at the side of the road at these points. These pillars are all cast-iron, with doors back and front for providing access to the interior. The switch gear is mounted on a slate panel, and consists of an omnibus bar connected with the feeder through knife switches, and with the ends of the trolley wire through plug switch fuses. This enables any feeder, or any section of either trolley wire, to be disconnected at will. Each of the pillars contains also a lightning arrester with kicking coils, and a telephone instrument of the hand combination type. Terminals are also provided for the test and telephone circuits.

The whole of the overhead construction, as well as the switch pillars, has been carried out by Messrs. Macartney, McElroy & Co., of Westminster.

The number of cars in service, when the whole of the system is completed, will amount to about 20 in all. The cars are of the double deck, single truck type, provided with the usual double motor equipment and series parallel controllers.

The cars have a seating capacity for 46 passengers, 22 inside and 24 outside. The length over platforms

is 26 feet 6 inches, and the length inside 15 feet 4 inches.

The seats on the upper deck are arranged longitudinally, back to back. This arrangement has been adopted in preference to the more usual garden seats on account of the limited head room at the Bar Gate.

The trucks are of the Brill Company's 21 E pattern. The wheels are 30 inches in diameter, and the wheel base is 6 feet. The motor equipment is of the Westinghouse Company's standard type, and the controllers are provided with an emergency rheostatic brake. When braking, the motors act as generators, and the power developed is absorbed in resistances. This is in addition to the ordinary hand brakes.

The trolley standards are of special design, the springs being placed inside the standards so as to be out of the way, and special care has been taken in designing the arrangement of springs, so as to ensure as uniform a pressure as possible on the trolley wire when the pole is brought down, in view of the lowness of the trolley wire at the Bar Gate. The trolley heads are of the side swivelling pattern.

Draw bars are provided for connection to trailer cars if these are found necessary in the future.

The contractors for the whole of the rolling stock were the Westinghouse Company, their sub-contractors for the trucks being the Brill Company, and for the car bodies Messrs. Milnes & Co., of Birkenhead.

There are two car depôts, the larger one being situated at Portswood, and the smaller one at Shirley; the latter provides accommodation for 20 cars, and the Portswood depôt for 12 cars. There is also a repairing shed, which will easily hold six cars. Smiths' and carpenters' shops, with full equipment of tools, fitters' benches, &c., are provided for dealing with any repairs which may be necessary.

The chairman of the Tramways Committee is Senior Bailiff Dunsford, who has been indefatigable in carrying out the work; the chairman of the Electricity Committee is Alderman Bone, who has also rendered valuable assistance.

The engineers for the whole of the scheme are Messrs. Kincaid, Waller & Manville, of Westminster. The borough electrical engineer, Mr. F. H. Chaplin, is responsible for the supply of power to the cars, while Mr. G. B. Carnon is the tramway manager.

A few notes regarding the lighting plant may be added. The station is of special interest, as it contains, in addition to the direct current generators and storage batteries for lighting and traction, a high pressure alternating current system, with rectifiers for the arc lighting. In criticising this somewhat heterogeneous assembly of machines, allowance should be made for the fact, that the station has passed from the hands of a company, which commenced supply in 1891, to those of the Corporation, and has grown to its present size by successive additions.

The main switchboard, by Messrs. Crompton & Co., Limited, is a large and imposing structure. It consists of 12 panels, arranged for the three-wire system. The switchgear provides for six generators and four feeders, besides a power circuit for the operation of the electric cranes on the docks (the latter will shortly be transferred to the tramway circuits). There is also a balancer, a double booster for charging, a lighting battery, and a motor alternator, all of which are controlled from the main board. The battery is of Messrs. Pritchetts & Gold's manufacture.

There are three Crompton-Brunton alternators, driven by Willans engines, besides the motor-alternator; the latter, by taking charge of the A.C. day load, renders it unnecessary to run the steam alternators in the day-time. One of our views shows the alternators; close to these are the Ferranti rectifiers, which are placed under the switchboard gallery. The A.C. generators and feeders are controlled by a Ferranti switchboard, of the well-known earthed outer type, with nine panels. We understand that the load on the A.C. system, which is of later date than the rest of the plant, has grown very rapidly.

In conclusion, we wish to express our indebtedness to Messrs. Kincaid, Waller & Manville, and Mr. F. H. Chaplin, who have provided us with particulars and facilities for obtaining photographs for the purpose of preparing this article.

Broughty Ferry.—The electric lighting scheme has been deferred indefinitely.

NOTES.

(*Continued from page* 102.)

Opening of Southport Electric Tramways.—The Corporation of Southport on Wednesday inaugurated the first portion of their electric tramway system. Early in the day members of the Town Council, accompanied by representatives from kindred authorities in Halifax, Sheffield, Bolton, and other towns, made a journey over the new lines in three gaily decorated cars. The cars started from Hoghton Street. A visit was paid to the electricity works on the return journey, and subsequently the party had lunch together at the Queen's Hotel. For a period of 25 years Southport has been served with trams drawn by horses, but in 1897 a special committee was appointed to consider the question of introducing electricity as the motive power, and also the desirability of extending the existing system. In 1899 the necessary provisional order was obtained, and the work of constructing lines on two new routes commenced in January of this year. The lines were laid to High Park and to Blowick, two districts hitherto untouched by the tramways. A sum of £66,000 was borrowed. They are now applying for sanction to borrow a further sum of £40,000 to acquire the undertaking of the Birkdale and Southport Tramways Company, and the Corporation are also negotiating with the Southport Tramways Company as to the use of their lines for electric traction until the termination of the lease they hold. There are within the borough nine miles of lines worked by horse traction, and the lines opened on Wednesday are about six miles in length. The Corporation are putting down another 3 miles, which will give a total length of 18 miles, or 1 mile to every 1,900 inhabitants. The plant at the electricity works will be capable of working 50 cars if need be, but the present scheme only includes the use of 25 cars. Mr. Trotter held a Board of Trade inquiry on Tuesday into the application of the Council for borrowing the £40,000 mentioned above.

Conduit Traction for London.—It is reported that the London County Council is about to have constructed at one of its depôts a short section of electric conduit line. Rumour has it that the Westinghouse are to do the work, the system being similar to the short length which was recently exhibited at the Agricultural Hall. The matter is purely an experiment.

Appointments Vacant.—The Kensington and Knightsbridge Electric Lighting Company want an assistant engineer at Kensington Court. See "Official Notices" to-day.

The Manchester Tramways Committee wants a traffic superintendent. See "Official Notices" to-day.

An electrician-in-charge is wanted for the Huddersfield electricity works at £2 per week. See "Official Notices" to-day.

The Hoylake and West Kirby District Council want an electrical engineer to act as clerk of works, and subsequently to run the electricity works. Salary £150 per annum. See "Official Notices" to-day.

Chatham Electric Lighting.—An expert is to advise the Council as to the value of the undertaking of the local electric light company, with a view to proposed municipalisation.

Dust Destructors.—The Colwyn Bay District Council, which is considering the advisability of extending the electricity works, is also going into the question of dust destructors, with a view to inviting tenders from the "best destructor builders."

Babcock & Wilcox, Limited.—On Monday next Messrs. Babcock & Wilcox remove from 147, Queen Victoria Street to more commodious offices at Oriel House, Farringdon Street, E.C.

Institution of Electrical Engineers.—We have received from the secretary, Mr. W. G. McMillan, particulars of the arrangements which have been made for the reception and entertainment of members of the American Institute of Electrical Engineers, who are expected to spend a few days in London on their way to Paris. The arrangements comprise a trip up the Thames in electric launches, a dinner in London, and visits to works in and around London; the two functions first mentioned are to be graced by the presence of ladies, and the Council hopes that a large number of members will take part in the entertainments, in order to do honour to the Institution's guests.

We have been informed that the title of the subject for discussion at the joint meeting of the Institution of Electrical Engineers and the American Institute of Electrical Engineers, in Paris, to be held in the American Pavilion in the Exhibition on the morning of Thursday, August 16th, is, "The Relative Advantages of Alternate and Continuous Current for a General Supply of Electricity, Especially with Regard to Interference with other Interests." We understand that it is specially desired to discuss how far interference with other undertakings, rather than ordinary commercial and industrial conditions, will come to be a determining factor in the selection between continuous and alternating currents.

Current Specifications.—We are informed by a correspondent that the Salford tramway specification for copper wire reads to him like ancient history. He says:—"In the first place no one can tell what 98 per cent. conductivity means. If this means 98 per cent. of Matthiessen's standard, I can only say that such copper wire is below the usual normal standard, which is generally in excess of 99 per cent. of Matthiessen's standard. As regards tensile strength, I should like to know where to get copper of the specified strength. Years ago we used to specify 5,000 lbs.; this was for tests made on smaller sizes of copper wire. In actual practice it is found that 4,500 lbs. is a maximum average, and there exists a great deal of doubt among those who have followed the matter closely as to whether 4,250 lbs. average is not better, since such copper is less brittle and less likely to give trouble."

Institution of Electrical Engineers—Students' Section.—A circular letter has this week been addressed to the students of the Institution of Electrical Engineers, informing them that the Council of the Institution proposes to grant £5 to each of 20 selected students to assist them to visit the electrical exhibits in the Paris Exhibition. Intending candidates must fill up and return an application form (issued with the circular) before 10 a.m. on Saturday, July 28th. In the selection the Council will give preference, other things being equal, to those who, being still students of the Institution, have either, or both, read papers before the Students' Section, or been members of the committee of that section. The conditions of the grant are as follows:—(1) The selected student shall spend at least six days in Paris, the visit to commence not earlier than August 27th. (2) He shall write an essay or a paper on the exhibits in a special section allotted to him, and shall send the paper to the secretary of the Institution before November 15th, 1900. (3) The paper submitted shall, like all other papers presented to the Institution, become the property of the Institution. If approved by the Council, it may be read at a meeting of the Students' Section, and, if so read, will be eligible for the usual Institution premiums offered for such papers.

SUPPLY STATION ACCOUNTS.

St. Pancras Vestry Electricity Accounts.

THE accounts of the Vestry of St. Pancras are always looked out for, as the period at which they are published comes round, owing to the supply being one of the earliest given by local authorities, and also because some curious features in the fluctuation of loss and profit have been shown in years gone by. A change in the details of the capital account, whereby the amount under the head of "Public lamps" has been *reduced* from £8,894 to £4,311, is explained by an altered policy on the part of the London County Council, who now require loans for street lighting to be taken up under the Metropolis Management Acts, and not the Electric Lighting Acts, and the capital account has been adjusted accordingly.

The growth of the undertaking is shown by a statement attached to the accounts, of which the following contains the first two and last two lines:—

Year.	No. of consumers.	Current sold to private consumers. At 3d. per unit.	At 4d., 5d., and 6d. per unit.	No. of lamps, &c., applied for. Incandescent 16-c.p.	Arc.	Motors.
1892	172	...	£8,167	9,900	82	11
1893	238	£385	9,161	12,851	110	19
1898	984	8,415	23,446	38,124	292	91
1899	1,184	11,700	25,993	46,172	315	126

The present position of the undertaking is shown by the

GENERAL STATEMENT.

	1898.	1899.	Increase.
Total capital expenditure ...	£241,994	**£288,147**	£46,153
Number of units sold	1,996,877	**2,477,508**	480,631
Maximum load in KW.	933	**1,789**	856
Gross revenue	£38,291	**£45,066**	£6,775
Gross profit	£13,766	**£17,650**	£3,884
Average price per unit sold ...	4·55d.	**4·29d.**	– ·26d.

The gross revenue for last year, including all sources of revenue amounts to the handsome figure of £45,066, an increase over the year 1898 of £6,775. Taking the revenue as given in the accounts the increase in revenue is over 17 per cent. and in units sold over 24 per cent. on the previous year. The rebate allowed to consumers charged on the demand indicator system amounted to £6,537. The receipts per unit have dropped by nearly a farthing, and now stand at about 4¼d.

REVENUE STATEMENT.

	1898. Gross.	1898. Per unit.	1899. Gross.	1899. Per unit.	Increase.
Sale of energy	£37,840	4·55d	**£44,332**	4·29d.	– ·26d.
Meter rents, &c.	46	·00d.	**98**	01d.	+ ·01d.
Work done and rents received.	390	·05d.	**628**	·06d.	+ ·01d.
Sundry fees, &c.	15	·00d.	8	·00d.	00d.
Gross revenue ...	£38,291	4·60d.	**£45,066**	4·36d.	– ·24d.

In the "costs" the raw materials, coal, oil, waste, water, &c., have gone up by $\frac{1}{10}$d., but as "wages" have fallen by this amount, the smaller cost of repairs leaves the works cost reduced by ¼d. to 2¼d. "Rent" and "salaries" respectively show increases beyond what would have been expected. The net result is that total costs stands at 2¾d., as against nearly 3d. in 1898. Mr. Baynes may be congratulated on being able to reduce his "repairs" and "wages" items, the latter of which is somewhat difficult to deal with in London works. The following figures relate to London works of a few years' standing:—

District.	Year.	Capital.	Units.	Max. load.	Per unit sold.	Works cost.	Total cost.
Hammmersmith	1899	£104,498	891,301	700 KW.	3·66d.	1·83d.	2·09d.
Hampstead ..	1·98	£125,410	1,001,916	917 KW.	5·49d.	2·14d.	2·58d.
Islington ..	1·99	£259,562	1,846,437	1,0 0 KW.	4·43d.	2·29d.	2·83d.
St. Pancras ..	1899	£288,147	2,477 508	1,789 KW.	4 29d.	2·23d.	2 66d.

COST OF PRODUCTION.

	1898. Gross.	1898. Per unit.	1899. Gross.	1899. Per unit.	Increase.
Coal	£7,029	·84d.	£9,499	**·92d.**	+ ·08d.
Oil, waste, water and engine room stores	828	·10d.	1,238	**·12d.**	+ ·02d.
Salaries and wages incurred in generation and distribution and attending public lamps.	5,002	·60d.	5,102	**·50d.**	– ·10d.
Repairs and maintenance of buildings, engines, boilers, dynamos, &c., and street lamps.	8,495	1·02d.	7,135	**·69d.**	– ·33d.
Works costs ...	£21,354	2·56d.	£22,974	**2·23d.**	– ·33d.
Rent, rates and taxes ..	631	·08d.	1,337	**·13d.**	+ ·05d.
Management expenses, salaries of managing engineer, secretary, clerks, &c.	1,140	·14d.	1,720	**·17d.**	+ ·03d.
General establishment charges, stationery and printing, law charges and insurance.	852	·10d.	885	**·08d.**	– ·02d.
Other expenses	548	·07d.	500	**·05d.**	– ·02d.
Total costs ...	£24,525	2·95d.	£27,416	**2·66d.**	– ·29d.

The Vestry decided to deal with the net profit of 1899, together with £5,892 from 1898, as follows:—Depreciation of accumulators, £1,000; depreciation of meters, £600; to the credit of the lighting rate, £2,000; to reserve account, £4,000, and £112 goes to cover bad debts, the remainder being carried forward.

PROFIT STATEMENT.

	1898.	1899.
Interest on loans	£6,558	£7,321
Sinking fund for repayments	2,941	3,374
Net profit carried forward or dealt with as above	4,267	6,955
Gross profit	£13,766	£17,650

Canterbury Corporation Electricity Accounts.

THE accounts of the electricity supply undertaking of the Corporation of Canterbury cover the first year of working. The results are remarkable from both the financial and the engineering standpoints. As a rule, the reviewing of accounts pertaining to stations having an output of less than 250,000 units is a dispiriting task, for the financial result is generally shown as a deficit or net loss. Notwithstanding some very creditable performances in the way of generating costs, the prices charged are often so low that the business is handicapped, and either the rates have to bear the burden, or the profits of future years are mortgaged to satisfy the desire to supply cheap electricity. This mistake has not been made at Canterbury. Mr. Hammond, who designed the Canterbury works, and Mr. Norman Staniland, who is the chief engineer, have every reason to be satisfied with the results, and may be congratulated upon the excellent figures that appear in the accounts.

GENERAL STATEMENT.

	189—.	1899.	Increase.
Total capital expenditure		£32,454	...
Number of units sold		152,553	...
Total maximum demand in KW.... ...		161 kw.	...
Gross revenue		£3,169	...
Gross profit		£1,913	...
Average price per unit sold		4·85d.	...

The price charged is 6d. per unit, subject to a small discount. Nearly three-quarters of the total revenue is derived from private supply, the result being that the average price per unit sold is just over 4½d. This is higher than many stations with similar outputs receive, but the policy adopted is sound. The public seldom object to pay 6d. per unit at the commencement of supply, while electric lighting is a novelty, and year by year as the financial status is ascertained there is margin allowing of reductions which are appreciated much more than if a start had been made with an unremunerative low rate.

REVENUE STATEMENT.

	189—. Gross.	189—. Per unit.	1899. Gross.	1899. Per unit.	Increase.
Sale of energy	...	...	£3,082	4·85d.	...
Meter rents, &c.	...	...	83	·13d.	...
Supply of lamps, &c.	...	...	4	·00d.	...
Sundry fees, &c.	...	...	...	...	...
Gross revenue ...	...	...	£3,169	4·98d.	...

The output was distributed as follows:—

Year.	Total units generated.	Units sold. Private supply.	Public lighting.	Number of public lamps.
1899	210,188	99,527 (£2,369)	53,026 (£813)	12 arc and 243 incandescent.

The costs are particularly low. "Coal" works out at a trifle over ½d.; wages and salaries together come to just over 1d.; "oil, waste, &c.," appear almost infinitesimal at ·03d.; while the same remark applies to "rent, rates, and taxes," the gross value of which is put down at £24! It is quite a novelty to find a small station in its first year selling 150,000 units with works cost of under 1½d. and total cost under 2d.

COST OF PRODUCTION.

	189—. Gross.	189—. Per unit.	1899. Gross.	1899. Per unit.	Increase.
Coal	...	...	£349	·55d.	...
Oil, waste, water and engine room stores.	...	...	17	·03d.	...
Salaries and wages incurred in generation and distribution, and attending public lamps.	...	...	315	·50d.	...
Repairs and maintenance of buildings, engines, boilers, dynamos, &c., and street lamps.	...	...	97	·15d.	...
Works costs	...	...	£778	1·23d.	...
Rent, rates and taxes ..	...	...	24	·01d.	...
Management expenses, salaries of managing engineer, secretary, clerks, &c.	...	...	358	·56d.	...
General establishment charges, stationery and printing, law charges and insurance	...	...	96	·15d.	...
Other expenses	...	...	...	...	...
Total costs ...	...	...	£1,256	1·98d.	...

These figures appear more prominent if set out with those of sundry other works of approximately the same size. While direct comparisons cannot safely be made, owing to the peculiarities of demand, costs, &c., in different towns, it is interesting to see the relations established by the following:—

Town.	Year.	Capital.	Units.	Revenue.	Average price per unit received.	Works cost.	Total cost.	Net profit or loss.
Tunb'dge Wells	1897	£31,275	258,641	£5,822	5·21d.	2·00d.	2·57d.	+£1,635
Cheltenham	1897	£55,091	248,516	£4,010	3·84d.	2·23d.	2·66d.	−£1,418
Halifax	1897	£56,322	239,814	£4,846	4·62d.	2·05d.	3·03d.	−£842
Belfast	1897	£52,066	201,833	£5,266	6·04d.	2·63d.	3·54d.	+£1,060
Yarmouth ..	1897	£33,632	190,000	£4,015	4·91d.	2·56d.	3·31d.	−£437
Ayr	1897	£35,978	161,093	£2,445	3·53d.	2·31d.	2·93d.	−£1,155
Canterbury ..	1899	£32,454	152,553	£3,169	4·85d.	1·23d.	1·98d.	+£406
Leyton	1897	£28,947	123,797	£1,802	3·14d.	2·05d.	2·59d.	−£737

PROFIT STATEMENT.

	1898—.	1899.
Interest on loans	...	£674
Sinking fund for repayments	...	833
Net profit carried forward	...	406
Gross profit	...	£1,913

CITY NOTES.

The National Telephone Company.

THE directors' report for the half-year ending June 30th, 1900, to be presented at the meeting to be held on Thursday, July 26, 1900, at 12 o'clock, reads:—

"The income accrued in respect of the business of the half-year amounts to £700,140 11s. as compared with £602,640 3s. 2d. for the corresponding period of 1899, being an increase of £97,500 7s. 10d. The working expenses for the half-year, including the special expenditure of £25,013 3s. 8d. incurred in repairing the damage caused by the snowstorm in February last, amount to £404,520 13s. 8d., as compared with £327,497 18s. for the corresponding period of 1899, being an increase of £75,022 15s. 8d. The net result for the half-year (after deducting the Post Office Royalties amounting to £68,357 9s. 7d.) is a profit balance of £227,262 7s. 9d. as compared with £216,257 6s 7d. for the corresponding period of 1899, being an increase of £11,005 1s. 2d., but the exceptional expenditure referred to in the preceding paragraph must be borne in mind. The rentals carried forward for unexpired terms of running contracts amount to £733,614 16s. 5d. as compared with £651,741 5s. at the corresponding period of 1899, or an increase of £81,873 11s. 5d. Out of the available balance of £178,195 9s. 1d. shown by the net revenue account (No. 3) the board will recommend the payment for the half-year of a dividend at the rate of 6 per cent. per annum, less income-tax, on the first and second preference shares, 5 per cent. per annum, less income-tax, on the third preference shares, and 6 per cent. per annum, less income-tax, on the ordinary shares. The board also propose to transfer £55,000 to the reserve fund, and to carry forward the balance of £4,325 9s. 1d. *Capital Expenditure.*—The sum of £366,223 16s. 9d. has been expended on capital account during the half-year in the erection of 11,696 additional exchange and private lines, and in the construction of underground lines. In considering the profit results of the half-year's working, it must be remembered how very adversely they have been affected by two exceptional causes:—First, the large amount of £25,013 3s. 8d. to repair the damage arising from the snowstorm in February; and second, the considerable increase in the cost of materials and labour consequent upon the abnormal commercial activity existing throughout the country. *Retiring Directors.*—At the general meeting four directors retire, and being eligible, offer themselves for re-election, viz., the Right Hon. Sir Henry Fowler, C.G.S.I., M.P., Mr. George Franklin, Sir Wm. Cuthbert Quilter, Bart., M.P., and Mr. Wm. Alexander Smith. *Retiring Auditors.*—The auditors, Messrs. Welton, Jones & Co., also retire, and are eligible for re-election."

British Columbia Electric Railway Company.

THE report of the directors for the year ended March 31st, to be submitted at the meeting to be held in London on 25th inst., states that the net earnings, which were £20,142 for 11½ months 1897-98, and £33,238 for 1898-99, have now reached £40,512. The ratio of working expenses to gross earnings has fallen by 4·18 per cent., which, on last year's earnings, would represent a saving of $17,237, or £3,554, and this amount forms part of the increased profit. The net profit for the year, after deducting London office expenses, amounts to £38,216, besides the balance brought forward, £189. From this the directors have provided for the payment of debenture interest, £11,250; preference share interest, £6,028. Deducting interim dividend on ordinary shares, £4,000, there remains for distribution, £17,127. From this the directors have decided to write off a further 20 per cent. of preliminary expenses, making in all 60 per cent. now written off, £1,218; to recommend a final dividend on the ordinary shares of 2 per cent., making 4 per cent. for the year, which will absorb £4,276; to transfer to general reserve, £500, bringing it up to £12,500; to transfer to capital amortisation account £5,500; to transfer to reserve account for depreciation £5,500, and to carry forward £132. In order to pro-

vide for the growth of the business, the directors recently made a further issue of 1,600 5 per cent. non-cumulative preference shares of £10 each. Notice is also given of an extraordinary general meeting to be held on 25th inst. for the purpose of sanctioning an alteration in the articles of association, the object of the board being to enable the company to obtain the benefit of the fees attached to any directorship which may fall vacant.

Calcutta Tramways Company.

MR. E. C. MORGAN presided at the meeting of this company at Cannon Street Hotel on Tuesday. Wholesale reconstruction of the lines had been going on during the year, and the difficulties of maintaining the service had been great. There was a decrease of 30,000 car-miles, for they had to run single track. A definite contract has been entered into for the completion of the new installation by December 31st, 1901, at a cost of £170,000. That sum does not include the cost of erecting the power house and the alteration of the car sheds, work which was being done by their own staff. They now had ample funds to meet present requirements. Any great expansion in the receipts could not be looked for until they had mechanical power.

The report was adopted.

Prospectus.

THE Castner Electrolytic Alkali Company (of the United States of America) has been before the public this week with an issue of £200,000 in 5 per cent. first mortgage debentures at the price of £90 per £100 debenture. The issue was made to provide funds to erect further plant and extend the works in America from their present capacity of 2,000 E.H.P. to at least 6,000 E.H.P., which it is estimated will cost £150,000 leaving a margin for ample working capital. The company acquires for two million dollars from the Mathieson-Alkali Works, the buildings, plant, and machinery, recently erected at Niagara Falls, and the Castner patents for the U.S. and Canada, and will carry on the business of manufacturers of caustic soda and bleaching powder under the Castner electrolytic process. The whole of the ordinary shares are allotted in payment of the purchase price. Subscriptions were being invited by the Castner-Kellner Alkali Company on Monday and Tuesday last.

The Direct United States Cable Company, Limited.

THE report of the directors for the six months ended June 30th, 1900, to be presented at the meeting at Winchester House on Tuesday, July 24th, at 2 o'clock, p.m., reads:—

Herewith the directors submit the usual statements of account for the half-year ended June 30th, 1900, which, with the half-year's accounts to December 31st, 1899, presented at the ordinary general meeting on January 30th last, show the financial result of the twenty-third year's working of the company. The half-year's revenue, after deducting out-payments, amounted to £52,204 8s. 7d., as compared with £51,951 8s. 2d. for the corresponding period of 1899, showing a difference of £253 0s. 5d. in favour of the half-year under review. The working and other expenses for the same period, including income-tax, amounted to £20,506 8s. 10d., leaving a balance of £31,697 19s. 9d. as the net profit, making, with £6,347 8s. 9d. brought forward from the previous half-year, a total of £38,045 8s. 6d. For the corresponding period of 1899 the working expenses and other payments amounted to £20,411 8s. 1d. Three quarterly interim dividends of 3s. each per share, amounting to £7,319 10s., have been declared and paid during the financial year, and a final dividend of 3s. per share is now proposed, together with a bonus of 2s. per share, making, with the three interim dividends, 3½ per cent. for the year, being a total distribution of £42,457. After transferring £10,000 to the reserve fund account, the balance of £3,761 8s. 6d. on the revenue account is proposed to be carried forward. The reserve fund account, having been credited with interest on the investments, realised profit, proceeds of sale, &c., of property at Torbay, Nova Scotia, and sum transferred from revenue account, now amounts to £418,575 5s. 9d., taking the investments at cost price. Pursuant to the provisions of the articles of association, two of the directors, viz., Chas. E Gunther, Esq., and Admiral of the Fleet the Hon. Sir Henry Keppel, G.C.B., D.C.L., retire by rotation, and being eligible, offer themselves for re-election. Messrs. Deloitte, Griffiths & Co., and Messrs. J. and J. Sawyer & Co., the auditors, retire pursuant to the articles of association, and offer themselves for re-election.

Eastern Telegraph Company.

THE directors, in their report for the six months ended March 31st last, state that the revenue for the period amounted to £543,683, from which are deducted £128,072 for the ordinary expenses and £27,939 for expenditure relating to repairs and renewals of cables, &c, during the half year. After providing £6,075 for depreciation of spare cable and £7,794 for income-tax, there remains a balance of £373,802, to which is added £33,660 brought from the preceding half-year, making a total available balance of £407,462. From this balance there has been paid interest on mortgage debenture stock, dividends on preference stock, and an interim dividend of 1¼ per cent. on the ordinary stock, leaving a balance of £298,924, out of which the directors have placed £10,000 to the reserve fund for maintenance of ships, £5,000 to the reserve fund in connection with the removal of head office, £2,000 to the reserve fund for the insurance of goods in transit, and £150,000 to the general reserve fund. The directors now recommend the declaration of a final dividend on the ordinary stock for the year ended March 31st, 1900, of 1¼ per cent. and a bonus of 2 per cent., amounting together to £130,000, both payable on the 19th inst., free of income-tax, and making, with the three previous payments on account, a total distribution of 7 per cent. for the year. The balance of £1,924 shown at the foot of the revenue account is proposed to be carried forward to the next half-year. The revenue includes £26,039 dividends for the half-year upon the company's shares in other telegraph companies. An agreement has been concluded between the Eastern Extension Telegraph Company and the Governments of South Australia, Western Australia, and Tasmania for establishing, in conjunction with this company, direct cables between South Africa and Australia, *viâ* the islands of Mauritius, Rodrigues, and Cocos, to Perth, with an extension to Adelaide. The section between Durban and Mauritius will be laid by this company. It has also been arranged to lay a cable between Ascension and Sierra Leone, under a subsidy from Her Majesty's Government. The order for the whole of these cables has been given, and they are in the process of manufacture. In connection with these important extensions, the tariff between the colonies and South and Western Australia and Tasmania and Europe was reduced from 4s. 9d. to 4s. per word on May 1st last, with proportionate reductions for Government and press telegrams. The agreement with the above Australasian colonies also provides for future reductions, under certain conditions, to a minimum of 2s. 6d. per word. There will also be substantial reductions in the tariff between the contracting colonies and South Africa when the new cables between Durban and Perth are completed. The meeting of the company was held yesterday at Winchester House.

Electric Construction Company, Limited.

THE seventh ordinary general meeting of the shareholders of this company was held on Thursday, July 12th, at Winchester House, Old Broad Street, E.C.

Mr. J. W. BARCLAY, who presided in the absence of Sir Daniel Cooper, said: I am happy to believe that the accounts and report which the directors have submitted to you require few remarks of mine to recommend them for your adoption. The results, on the whole, are very similar to those of last year. The general outcome is that we have to deal with a profit of £21,729 1s. 9d., and this we propose to do by paying the fixed preferential dividend and distributing 6 per cent. to the ordinary shareholders, carrying the balance of £4,777 1s. 9d. to the credit of next year's profit and loss account. The cost of maintaining the works, renewing and upholding the plant, adequate provision for bad debts and other liabilities, and £5,000 to the credit of the general depreciation account, come all out of profits as usual. You will observe that for the past seven years we have applied £33,000 of our profits in reducing the capital account, while the works, I am sure, have now more capacity for earning dividends than ever before. The accounts require few explanations—they speak for themselves. The figures in the profit and loss account are very much the same as last year. The expenditure has always a tendency to grow, and it is our business to limit the increase to what is necessary for maintaining due efficiency. The balance-sheet shows the expenditure so far on the extensions. Of the additions to plant and furniture during the year, £5,798 has been for additional tools in the old works, and the balance of £9,785 is made up by payments to account of plant for the extensions. If explanations respecting any other accounts are required I shall be happy to give them. At last general meeting you were informed that we had contracted for additions to our workshops, including, of course, plant to equip them, which costs a good deal more than the buildings. The structure of the additional shops has been finished, and is now being filled with tools and appliances of the latest improved description for facilitating the outturn of work and for reducing the amount of hand labour in the process of construction. When the shops are finished I do not hesitate to say that they will be in every respect the best in the kingdom for manufacturing large electrical machines. During the last seven years the size of the machines we are required to produce has very largely increased—as many as four times over—but while it is unsafe to predict the developments which may take place in electrical machinery, practical considerations lead to the conclusion that the limit of size has nearly been ascertained, and we are of opinion that our works will be able to cope with the largest machines that will be required of any electrical installation in the kingdom. As mentioned in the report, we have, during the past year, successfully completed the equipment of the City and South London Railway extensions with plant and appliances of exclusively British manufacture. This seems to be a sufficient answer to those who assert that British manufacturers cannot produce the best machinery for electric traction. The system adopted on the City and South London Railway to meet the condition of distributing power over a considerable length of line from one generating station has not been borrowed from the United States, and it was indeed, I believe, prophesied by some of our trans-Atlantic competitors that the system would prove a failure, but those prophets seem to have forgotten that the Electric Construction Corporation equipped the Liverpool Overhead Electric Railway before there were any overhead electric railways in America. These facts should encourage British corporations to have more confidence in their own countrymen and not accept implicitly the assertions of interested rivals. You have no doubt also observed in our report with much satisfaction that the relations between the board and employés of all classes are thoroughly harmonious. While anxious to do our best for our shareholders, we do not forget the interests of those on whose cordial co-operation so much of our success depends. Confidence between employers and employed is a plant of slow growth, but we believe that seven years' experience has taught our employés that their directors have their interests also at heart, and, in consequence, a feeling of *esprit de corps* has grown up, and each man feels an individual interest in, and is proud of, his connection with the company. As to the future, we are full of orders, so much indeed that we are pressing forward the completion of our new shops to enable us to execute them without undue delay. The prices at which we are booking orders give promise of fair profit, although we may, of course, complain that competition does not allow us the profits we would like, and that we think we ought

to have, but our new extensions will, after a time, give us an increased output larger than the proportion of increased standing charges they involve, and the saving thus effected will probably be divided between ourselves and customers. Gentlemen, I hope you will recognise that your directors are endeavouring to keep abreast of the times, and I have confidence that the skill and capacity of our establishment will give us results at least as good as our neighbours. On the whole, then, gentlemen, I believe that our position in the manufacturing world is becoming more and more firmly established, and that we may regard the future with confidence. I may mention that the company has sent 20 or 30 of our leading men over to Paris in order that they may see what is being done in the electrical world. It will give them the opportunity of seeing what is being turned out on the Continent. But perhaps our position induces us to believe that there is no better electrical machinery in the world than in the Midlands.

Sir H. C. Mance, C.I.E., seconded the motion, which was carried, as were resolutions for the re-election of the retiring directors and auditors.

Electrical Power Storage Company, Limited.

The eleventh ordinary general meeting of the shareholders of this company was held on Thursday, July 12th, at the offices, 4, Great Winchester Street, Mr. J. Irving Courtenay (chairman) presiding.

The Chairman, in moving the adoption of the report, said that after paying debenture interest and adding about £1,250 to reserve and contingent funds—now amounting to the substantial sum of £13,000—a balance of £4,620 16s. 1d. remained available for distribution. Out of that the directors recommended a similar dividend to that paid for the last seven years, namely, 5 per cent., which would absorb £4,362 8s. 5d., leaving £258 7s. 8d. to be carried forward. The new buildings were now being utilised to their full extent, and indeed so much had the business increased that even these additions were found hardly sufficient. The development of the business had necessitated the introduction of further working capital, and a call of £1 per share had been made during the year on 3,132 ordinary shares, on which only £3 per share had been previously paid. The works were in good condition, and the increase in their capacity had resulted in considerable economies in production. The average price which the company paid for their staple article, lead, during the financial year under review was 22 per cent. in excess of that paid in the previous year. He might add that the persistent rise in the prices of raw materials had necessitated their adding a further 5 per cent. to their list prices for manufactured goods, which increase came into force on July 1st. The rise in prices of raw materials was a condition which had to be faced by nearly every commercial manufacturing company and firm. There had been no falling off in the severe competition which existed in the storage battery industry. The directors thought, therefore, that the company had reason to be satisfied with the result of the year's trading, especially when it was remembered that besides increasing their reserves, they had thoroughly maintained the buildings, plant, and tools of the company at a cost of £1,646 6s. 5d., and had written off £748 3s. 9d. for depreciation, both having been provided out of revenue. As intimated at the last meeting, the directors had sent an exhibit to the Paris Exhibition. Though the exhibit was not a large one, they had endeavoured to make it as effective as possible; they hoped to direct special attention to the company's traction types of cells, and as a consequence, to increase their market for these goods. The cost of the exhibit had been debited to the revenue of the year. The special type of battery they had introduced for power and tramway stations had proved a great success. The battery installed two years ago in Liverpool for the first experimental tramway line of the Corporation had proved so satisfactory, that during the year they had obtained contracts for a further six batteries for use in various parts of the city in connection with the different tramway routes. These contracts were obtained at a figure in excess of that quoted by their competitors, owing to the satisfactory working of the first battery installed. A battery of a similar type had been installed for the Bradford Corporation during the year, and they had also obtained an order from them for a duplicate battery, in addition to which, amongst many others, they had installed batteries for the Corporations of Birkenhead, Bury St. Edmunds, Doncaster, Gloucester, Wigan, the Metropolitan Electric Supply Company, and Royal Mint. The company's works were never busier, and among the more important contracts in hand were two large batteries for the Liverpool Overhead Railway; also batteries for the Corporations or Urban District Councils of Barnes, Birkenhead, Doncaster, Horsham, Ilford, Motherwell, Rotherham, and Walsall. Since the last meeting, the London Electrical Cab Company had ceased operations, and had been put into the hands of a receiver for the debenture holders. This was unfortunate in the interests of electric traction, but he could state emphatically that the non-success of the cab company was in no way due to any failure of the Faure-King batteries to do their stipulated work, and resulted from causes entirely unconnected with the accumulators. He was glad to say, however, that he had been informed that arrangements were in progress by which electrical broughams, fitted with the latest improvements and E.P.S. batteries, would shortly be available in London. He could not conclude without referring to the death of their esteemed colleague, Mr. Frank King, and paying a tribute to the work carried out by him during the many years he was manager of the company. To his organising ability, and his skill as an electrical engineer, especially in connection with accumulators, he considered the company in large measure owed its present prosperous condition. He had left an impress of his energy and industry on the accumulator business generally, which he felt certain would preserve his memory for many years to come. In some respects the year just closed had been an anxious one for the directors and the staff, but he trusted, with the return of peace, prices would settle somewhat. Electric lighting and traction were being taken up all over the country on an ever-increasing scale, and as accumulators were recognised as a necessity for economical working, he thought the future of the company looked bright.

Sir James Pender, Bart., M.P., seconded the motion for the adoption of the report and balance-sheet and declaration of the dividend, which was carried unanimously.

Telegraph Construction and Maintenance Company, Limited.

The half-yearly general meeting was held at 38, Old Broad Street E.C., on Tuesday, Sir Robert Herbert presiding.

The Chairman said there was no formal business to be transacted; they had only the somewhat monotonous—but not on that account unacceptable—statement to make of the continued prosperity and industry of the company. Their factories had been closely employed since they met last, in doing good work, and so had their ships. Their new cable ship the *Anglia*, which they had mentioned on several occassions as being a very satisfactory acquisition, had lately completed one voyage, and was about to enter upon another laden with a greater amount of cable than had ever before been carried by any telegraph cable ship. On its last voyage it had given utmost satisfaction in all ways, and was a great strength to the company. They had work in hand which would occupy them sufficiently well during the remainder of the year, and they did not anticipate that there would be any less favourable account to render at the next annual meeting than on the last and several preceding occasions.

Mr. Croft (a shareholder) asked a question regarding the Pacific cable scheme, for which tenders were now being advertised. Was the company in a favourable position with regard to tendering for that cable, or could the chairman tell them anything about the matter?

In reply, the Chairman said that they had only just received the detailed specifications, and the board had not had time to give them that close consideration which they must certainly receive. The proposals of the Government were that the work should be divided into three sections, the long one from Vancouver to Fanning Island, or either of the smaller sections. A company might tender for the Vancouver and Fanning Island section, and if it had the means in its establishment, might be able to undertake others also. Whether this company would be able ever to do that very exceptional work at prices which would satisfy the Australian Colonies and Canada that they ought to incur the expenditure they could not say, but they were quite sure that no other institution had a better prospect of being able to do the work, both economically and soundly, than the T. C. & M. Company. They would give the matter their very closest attention, and it was not impossible that they might see their way to take some part in the affair.

The usual vote of thanks closed the meeting.

Stock Exchange Notices. — The Committee have appointed a special settling day as under:—Thursday, July 26th, Bournemouth and Poole Electricity Supply Company, Limited — £70,000 4½ per cent. debenture stock, and have ordered same to be quoted in the Official List; Robey and Co., Limited—20,464 ordinary shares of £10 each, fully paid, 7,146 preference shares of £10 each, fully paid, and £125,000 4½ per cent. first mortgage debentures of £100 each are also to be quoted. Applications have been made to the Stock Exchange Committee to appoint a special settling day in and to grant a quotation to:—Babcock & Wilcox, Limited—Ordinary shares of £1 each, and preference shares of £1 each; Metropolitan Electric Supply Company, Limited—Further issue of £125,000 3½ per cent. mortgage debenture stock; and to allow the following to be quoted in the Official List:—British Aluminium Company, Limited—20,000 7 per cent. cumulative preference shares of £10 each, fully paid, Nos. 1 to 20,000. (Renewed application.)

National Telephone Company.—The directors have resolved, subject to final audit, to recommend the following dividends for the half-year ending June 30th last, after charging £25,013 to revenue, being the special expenditure incurred in repairing damage caused by the snowstorm in February last, at the rate of 6 per cent. per annum, less income-tax, on the first and second preference shares. At the rate of 5 per cent. per annum, less income-tax, on the third preference shares. At the rate of 6 per cent. per annum, less income-tax, on the ordinary shares, carrying £55,000 to reserve, and about £4,000 forward. The transfer books of the company will be closed from the 16th to 26th inst. Dividend warrants will be posted on 26th.

City and South London Railway Company.—The accounts for the half-year ended June 30th show a balance, after providing for the debenture interest, the full dividend on the 5 per cent. preference stock, 1891, and on the 5 per cent. preference stock, 1896 (less two months' dividend paid out of capital on the latter), sufficient to allow the payment of a dividend on the consolidated ordinary stock (amounting to £855,000) at the rate of 1¼ per cent. per annum, carrying forward a balance of £788. The dividend for the corresponding period last year on £630,000 ordinary stock was at the rate of 2¼ per cent. per annum, the balance carried forward being £1,107.

The Edison & Swan United Electric Light Company, Limited.—The directors have, subject to audit, determined to recommend the payment of a dividend in respect of the six months ending June 30th, 1900, at the rate of 6 per cent. per annum, on the "A" share capital. The above distribution, together with the interim dividend at the rate of 6 per cent. per annum already paid in February in respect of the first half-year, will be equal to a dividend of 6 per cent. for the year. The dividend warrants will be posted on July 31st, 1900. The transfer books will be closed from the 18th to the 31st inst.

Anglo-American Telegraph Company, Limited.—The directors have resolved, after placing the sum of £6,000 to the credit of the renewal fund, to declare an interim dividend for the quarter ending June 30th, 1900, of 15s. per cent. on the ordinary stock and £1 10s. per cent. on the preferred stock, less income-tax, payable on August 1st to the stockholders registered on the books of the company on June 30th, 1900. After paying the foregoing dividends there will be a balance of about £8,700 to be carried forward to the next account.

The City of London Electric Lighting Company, Limited.—The directors have decided to declare an interim dividend on the preference shares at the rate of 6 per cent. per annum for the half-year ended June 30th, 1900, the said dividend to be payable on the 3rd prox. to the shareholders registered in the books of the company on the 19th inst.

Westminster Electric Supply Corporation.—The new issue, partly-paid share certificates if required, can be obtained in exchange for allotment letters and bankers' receipt. Fully-paid share certificates will be prepared and will be available for exchange after October 1st next on payment of the final instalment.

The British Continental Electricity Company, Limited.—The meeting of this company was held at 82, Victoria Street, S.W., last Friday. The report, which was published in last week's Electrical Review, was adopted. Mr. W. A. Brodie, who presided, said that the rise in the price of coal had been a most unfortunate contingency. It had reduced the profit by £300. A dividend of 2¾ per cent. per annum was declared on the 5½ per cent. cumulative preference shares for the half year ended April 30th, 1899. The full dividend has been paid on the preference shares for the past year, and 2 per cent. on the ordinary shares for the past half year.

Notting Hill Electric Lighting Company.—A small meeting of this company was held on Monday afternoon, but the proceedings were not open to press representatives, and the nature of the business did not transpire.

St. James's and Pall Mall Electric Light Company, Limited.—The directors have declared a dividend for the half-year ended June 30th at the rate of 10 per cent. per annum on the ordinary shares.

British Insulated Wire Company, Limited.—Dividend warrants for the half-year ended June 30th on the preference shares at the rate of 6 per cent. per annum, less income tax, have been posted.

United River Plate Telephone Co.—Allotment letters have been posted in respect to the whole issue offered of £23,361 5 per cent. cumulative preference shares.

TRAFFIC RECEIPTS.

The Blackpool and Fleetwood Tramroad Company.—The receipts for the week ending July 14th, 1900, were £948 19s. 10d.; receipts for corresponding period, 1899, £913 18s. 2d.; aggregate for half-year to date, £1,750 8s. 6d.

The Bristol Tramways and Carriage Company, Limited.—The receipts for the week ending July 13th, 1900, were £3,603 15s. 11d.; corresponding period, 1899, £3,579 5s. 4d.; increase, £24 10s. 7d.

The City and South London Railway Company.—The receipts for the week ending July 15th, 1900, £1,436; July 16th, 1899, £861; increase, £575. Total receipts for half-year, 1900, to date, £2,898; corresponding period, 1899, £1,898; increase, £985. Miles open, 1900, 4¼; 1899, 3¾.

The Cork Electric Tramways and Lighting Company, Limited.—The receipts for the week ending Thursday, July 12th, 1900, were £526 0s. 9d.; corresponding week last year, £462 4s. 9d.; increase, £63 16s. 7d. Total to July 12th, 1900, £10,599 11s. 9d.; corresponding period last year, £9,393 5s. 2d.; increase, £1,206 6s. 7d.

The Dover Corporation Tramways.—The receipts for the week ending July 14th, 1900, were £272 12s. 4½d.; July 15th, 1899, £258 15s. 8d.; increase, £13 16s. 8½d. Total receipts to date, 1900, £5,009 17s. 9d.; corresponding period 1899, £4,710 4s. 4d.; increase, £229 13s. 5d. Miles of track open, 1900, 3; 1899, 3. Car miles run, 1900, 5,153; 1899, 4,722. Number of cars, 1900, 11; 1899, 11.

The Dublin United Tramways Company.—The receipts for the week ending Friday, July 13th, 1900, were as follows:—D. U. T. Co., horse cars, £35 14s. 5d.; ditto, electric cars, £3,849 16s. 1d.; D. S. D. Co., electric cars, £1,144 15s. 4d.; total, £5,030 5s. 10d; corresponding week last year—D. U. T. Co., horse cars, £2,044 13s. 8d.; ditto, electric cars, £1,216 7s. 4d.; D. S. D. Co., electric cars, £1,022 16s. 6d.; total, £4,283 17s. 6d.; increase, £746 8s. 4d.; aggregate to date, £9,027 1s. 8d.; aggregate to date last year, £8,074 4s. 2d.; increase to date, £952 17s. 6d. The mileage worked is 42 miles electrically, 2 miles by horses, as against 18 miles electrically, 26 miles by horses, for the corresponding period last year.

The Liverpool Overhead Railway Company.—The receipts for the week ending July 15th, 1900, were £1,755; corresponding week last year, £1,593; increase, £162. Total traffics from July 1st, 1900, £3,442; ditto corresponding period 1899, £3,132; increase, £310. Miles open 6·57 chains.

STOCKS AND SHARES.

Wednesday Evening.

The political outlook and the heat combined have practically suppressed Stock Exchange business. Only in one or two of the more speculative departments has there been anything doing this week: the railway markets fell to pieces at the wretched dividend results announced so far, but the number of actual bargains booked has been extremely small. The Chinese horror still hangs as a cloud of depression over the Stock Exchange, and fears of another national loan for war exigencies are damping all investment sections.

City and South London stock weakened upon the declaration of the dividend, which is at the rate of 1¼ per cent per annum—1 per cent. less than it was this time last year. There were no sellers in the market, the dealers simply marking the price down in anticipation of those who might come in when the news became spread. Waterloo & City has also fallen a trifle, the numberless cheaper investments which are now on offer tempting proprietors to change their holdings for something which returns more interest. Central London shares are all better, whole and half shares alike, the Berlin selling having ceased. The final Board of Trade inspection took place to-day (Wednesday), and it is hoped that the line may now open any day for public traffic.

British Electric Traction shares exhibit no alteration, but Imperial Tramways are harder at 23. This is the company which virtually owns the London United Tramways, whose comprehensive Bill for running powers to Hampton Court has at last gone through Parliament. The company's lines from Kew to Hammersmith, on which the electrical experiments are so soon to be tried, are fast assuming their new aspect, and rumour puts their completion some time in September.

As regards the latest issues, British Electric new fractions are 7s. to 9s., the Preference being 3s. cheaper. Calcutta Electric Lighting new are ¼ to ½ premium, the old standing at 6½.

In the supply market the state of business is perhaps best described in the words of the Scotchman who, when asked if he did not miss his wife after her death, replied that it was "verra dull, but verra peaceful." City of London Electric fell as a result of the meeting, which showed that the shareholders were by no means unanimous in wishing to grant the extra borrowing powers asked by the directors. The motion was agreed to, as we reported last week, but the board met with some sharp criticism, not wholly unjustified, in connection with the short time allowed for shareholders to make up their minds on the point.

The Charing Cross and Strand Company is issuing 30,000 new Preference shares of £5 each at a premium of 2s. 6d. per share. The new shares will not rank with the existing Preferences until next year, and as the latter stand at 5⅜, the Charing Cross Company is certainly plucky to ask a premium for the new issue. It is offered to both Ordinary and Preference shareholders in the proportion of three new shares for every seven held at present. We hear circumstantial rumours of a fresh emission, too, from the County of London Company, which will probably take the shape of more 4½ per cent. debenture stock. And we should not be absolutely astonished if it were to be offered at 108, which is about 2 per cent. below that which the present issue now commands.

By a slip of the pen last week, we gave the lowest prices of Chelsea's and St. James's during 1900 as 6¾ and 14⅜ respectively. The figures should, of course, have read 6½ and 14.

The amalgamation rumour of the Welsbach and the Sunlight Incandescent Companies was marked by a sharp rise in the stocks and shares of both. Undoubtedly the scheme will immensely benefit each enterprise, and it may be that with the Welsbach's electric mantle coming on the market in a few weeks' time, the unfortunate shareholders may see some of their money back again.

Anglo-American Telegraph Stocks experienced a sharp set-back upon the appearance of the directors' statement, showing nearly £16,000 less to be carried forward as compared with last year's figures, although the dividends on the Ordinary and Preferred are maintained. Seeing that a prominent official of the company told us only a few weeks ago that the Anglo-American's traffics were, up to that time, rather ahead of the 1899 results, we can only surmise that the company has been very unlucky in finding renters of its steamer, from which a large profit was made last year. This, however, will be ascertainable by the report. The Eastern market is steady, "Chinas" having recovered the dividend of 2s. 6d. per share deducted on July 12th. Eastern Ordinary shows no disposition to move. There is nothing worthy of note in the telephone department.

The electric tramway company for Havana, whose coming we heralded weeks ago, will probably be offered to the public in a few days' time.

SHARE LIST OF ELECTRICAL COMPANIES.—TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. ‡	Dividends for the last three years. 1897.	1898.	1899.	Closing Quotation July 11th.	Closing Quotation July 18th.	Business done during week ended July 18th, 1900. Highest.	Lowest.
110,900	African Direct Telegraph, 4 % Debs.	100	...	...	...	99 —103	99 —103	...	...
125,000	Amazon Telegraph 5 % Debs., Nos. 1 to 1,250 Red.	100	...	...	...	85 — 90	85 — 90	...	...
875,520	Anglo-American Telegraph	Stock	3 %	£3 9s.	73/6	60 — 63	59 — 62	...	...
3,062,240	Do. do. 6 % Pref.	Stock	6 %	6 %	6 %	113½—114½	113½—114½	114½	113½
3,062,240	Do. do. Deferred	Stock	...	18s. %	£1 7s.	12½— 13	11⅝— 12¼	12 1⅝	11 1⅝
44,000	Chili Telephone, Nos. 1 to 44,000	5	4 %	3 %	...	2½— 3½	2½— 3½	...	...
10,000,000$	Commercial Cable	$100	8 %	8 %	...	165 —175	165 —175	...	...
1,563,078£	Do. do. Sterling 500 year 4 % Deb. Stock Red.	Stock	...	...	...	101 —103	101 —103	102¼	101¼
16,000	Cuba Telegraph	10	7 %	8 %	7 %	6½— 7½	6½— 7½	...	...
6,000	Do. 10 % Pref.	10	10 %	10 %	...	15½— 16½	15½— 16½	16	...
12,931	Direct Spanish Telegraph	5	4 %	4 %	...	4 — 5	4 — 5	...	...
6,000	Do. do. 10 % Cum. Pref.	5	10 %	...	...	9 — 10	9 — 10	...	...
30,000	Do. do. 4½ % Debs.	50	...	...	...	100 —104%	100 —104 %	...	...
60,710£	Direct United States Cable	20	3¼%	3½%	3 %	11½— 12	11½— 12	11⅝	11½
111,000	Direct West India Cable, 4½ % Reg. Deb.	100	...	...	...	99 —102	99 —102	...	...
4,000,000	Eastern Telegraph, Ord. Stock	Stock	7 %	7 %	7 %	148 —153	148 —153	151	148
1,795,000	Do. 3½ % Pref. Stock	100	...	...	...	97 —100	96 — 99 xd	98	96
1,432,268£	Do. 4 % Mort. Deb. Stock Red.	Stock	4 %	...	...	111 —116	111 —116	...	...
250,000	Eastern Extension, Australasia, and China Telegraph	10	7 %	7 %	7 %	14⅝— 15¼	14⅝— 15¼xd	15⅛	14⅞
6,700£	Do. 5 % (Aus. Gov. Sub.) Deb., 1900, red. ann. drgs., reg. 1—1,049, 3,976—4,326	100	5 %	...	...	... — ...	... — ...	...	...
26,600£	Do. do. Bearer, 1,050—3,975, 4,327—6,400	100	5 %	...	...	... — ...	... — ...	...	...
320,000£	Do. 4 % Deb. Stock	Stock	4 %	...	...	112 —117	112 —117	...	...
300,000£	Eastern and South African Telegraph, 4 % Mort. Deb. Nos. 1 to 3,000, red. 1909	100	...	...	...	100 —103	100 —103	...	...
200,000£	Do. 4 % Reg. Mt. Debs. (Mauritius Sub.) 1—8,000	25	...	...	...	100 —103%	100 —103%	...	...
180,227	Globe Telegraph and Trust	10	4½%	5⅛%	5¼%	11¼— 11⅝	11¼—11⅝	11 7/16	11¼
180,042	Do. do. 6 % Pref.	10	6 %	6 %	...	15 — 15½	15 — 15½	15⅝	15⅛
150,000	Great Northern Telegraph, of Copenhagen	10	10 %	12½%	...	32 —34	32 — 34	...	...
84,300	Halifax and Bermuda Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	...	...	...	98 —101	98 —101	...	...
17,000	Indo-European Telegraph	25	10 %	10 %	10 %	52 — 56	52 — 56	...	...
100,000£	London Platino-Brazilian Telegraph, 6 % Debs.	100	6 %	...	...	105 —108	105 —108	...	...
72,680	Montevideo Telephone, Limited, Ord., Nos. 1 to 72,680	1	...	...	...	⅛— ¼	⅛— ¼	...	...
86,492	Do. do. do. 5 % Pref., Nos. 1 to 86,492	1	4 %	4 %	2½%	¾— 1	¾— 1	...	...
490,000	National Telephone, 1 to 490,000	5	6 %	6 %	5 %	4⅛— 5⅛	4⅛— 5⅛	5 1/16	...
15,000	Do. 6 % Cum. 1st Pref.	10	6 %	6 %	6 %	13 — 15	13 — 15	14 3/16	13⅝
15,000	Do. 6 % Cum. 2nd Pref.	10	6 %	6 %	6 %	12 — 14	12 — 14	...	...
250,000	Do. 5 % Non-cum. 3rd Pref., 1 to 250,000	5	5 %	5 %	6 %	5 — 5¼	5 — 5¼	5¼	...
2,000,000£	Do. 3½ % Deb. Stock Red.	Stock	3½%	3½%	3½%	97 —100	97 —100	98	...
171,504	Oriental Telephone and Elec., Nos. 1 to 171,504, fully paid	1	5 %	5 %	5 %	⅞— 1⅛	⅞— 1⅛	...	...
100,000£	Pacific and European Tel., 4 % Guar. Debs., 1 to 1,000	100	4 %	...	...	100 —103	100 —103	...	...
11,839	Reuter's	8	5 %	5 %	5 %	7½— 8½	7½— 8½	7⅝	7½
3,381	Submarine Cables Trust	Cert.	...	...	...	125 —130	125 —130	...	...
58,000	United River Plate Telephone	5	5 %	6 %	7 %	5 — 5½	4⅞— 5¼	...	...
16,639	Do. do. 5 % Cum. pref. Nos. 1—16,639	5	...	...	...	5 — 5½	5 — 5¼	...	...
179,947	Do. do. 5 % Debs.	Stock	...	...	...	104 —107	104 —107	...	...
200,000£	West African Telegraph, 5 % Debs.	100	...	...	...	97 —100	97 —100	...	...
30,008	West Coast of America, Nos. 1—30,000 and 53,001—53,008	2½	...	...	...	⅛— 1	⅛— 1	...	...
150,000	Do. do. 4 % Debs., 1—1,500 gua. by Braz. Sub. Tel.	100	...	...	...	99 —102	99 —102	...	...
389,731	Western and Brazilian Telegraph 4 % Deb. Stock Red.	Stock	...	...	...	102 —105	... — ...	...	...
207,930	Western Telegraph, Ltd., Nos. 1—207,930	10	7 %	7 %	...	14⅜— 15¼	14⅜—15¼ xd	15	...
75,000	Do. do. 5 % Debs. 2nd series, 1906	100	...	...	...	103 —106	103 —106	...	...
88,321	West India and Panama Telegraph	10	¾%	2 %	⅝%	⅝— ⅞	⅝— ⅞	...	...
34,563	Do. do. do. 6 % Cum. 1st Pref.	10	6 %	...	...	6½— 7½	6½— 7½	...	...
4,669	Do. do. do. 6 % Cum. 2nd Pref.	10	6 %	...	...	6 — 7	6 — 7	...	...
80,000£	Do. do. do. 5 % Debs., Nos. 1 to 1,800	100	5 %	...	...	102 —105	102 —105	...	...

ELECTRICITY SUPPLY COMPANIES.

19,661	Brompton & Kensington Elec. Lt. Sup., Ord., 101 to 19,761	5	4 %	6 %	6 %	7 — 8	7 — 8	...	...
12,000	Do. do. 7 % Cum. Pref.	5	7 %	...	...	8½— 9½	8½— 9½	...	...
50,000	Charing Cross and Strand Electricity Supply	5	7 %	8 %	9 %	9⅜— 10⅜	9⅜— 10⅜	10⅜	10
20,000	Do. do. do. 4½% Cum. Pref.	5	...	...	...	5½— 6	5½— 6	...	...
34,000	*Chelsea Electricity Supply, Ord.	5	6 %	6 %	6 %	6 — 7	6½— 7½	6⅞	...
150,000	Do. do. do. % Deb. Stock Red.	Stock	4½%	...	...	107 —110	107 —110	...	...
60,000	City of London Electric Lighting, Ord. 40,001—100,000	10	10 %	6 %	4 %	8½— 9½	8 — 9	8 1/16	8¼
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	...	12 — 13	12 — 13	...	...
400,000	Do. 5 % Deb. Stock, Scrip. (iss. at £115) all paid	...	5 %	...	...	122 —127	122 —127	...	...
40,000	County of Lond. & Brush Prov. Elec. Ltg., Ord. 1—40,000	10	*nil*	*nil*	4 %	8½— 9½	8½— 9½	9½	...
20,000	Do. do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	...	11½— 12½	11½— 12½	...	...
200,000	Do. 4½ % Deb. Stock, Prov. Certs (all paid) Rd.	...	...	...	...	108 —111	107 —110	107½	...
26,100	Edmundson's Elec. Corp., Ord. Shares	5	5 %	7 %	...	4½— 5	4½— 5 xd	...	...
75,000	Do. do. 4½ % 1st Mort. Deb. Stock.	100	...	...	...	101 —104	99 —102 xd	98¼	...
110,000	London Electric Supply Corporation, Limited, Ord.	3	...	...	...	1 — 1½	1 — 1½	...	...
49,840	Do. do. do. do. 6 % Pref.	5	...	6 %	...	4 — 4½	4 — 4½	...	...
250,000	Do. do. do. 4% 1st Mt. Db. Stock Rd.	Stock	...	...	...	98 —100	98 —100	...	...
85,000	Metropolitan Electric Supply, 101 to 62,500	10	6 %	5 %	5 %	14½— 15½	14½— 15½	15	14¼
220,000£	Do. 4½% First Mortgage Debenture Stock	...	4½%	...	...	111 —114	111 —114	...	...
220,000	Do. 3½% Mort. Deb. Stock Red.	Stock	...	...	...	96 — 98	96 — 98	...	...
6,452	Notting Hill Electric Lighting	10	6 %	6 %	7 %	15½— 16½	15½— 16½	...	...
40,000	St. James's and Pall Mall Electric Light, Ord.	5	14½%	14½%	14½%	13½— 14½	13½— 14½	14¼	...
20,000	Do. do. 7 % Pref., 20,081 to 40,080	5	7 %	7 %	7 %	8½— 9½	8½— 9½	...	...
12,000	Smithfield Market Elect. Supply, Ord.	5	...	...	...	2 — 2½	2 — 2¼	...	...
50,000	Do. do. 4 % Deb.	100	...	...	...	85 — 95	85 — 95	...	...
65,000	South London Electricity Supply, Ord.	5	...	...	...	3¾— 4¼	3¾— 4¼	...	...
79,900	Westminster Electric Supply, Ord., 101 to 80,000	5	12 %	12 %	13 %	12 — 13	12 — 13	13	12 7/16

* Subject to Founders Shares. † Quotations on Liverpool Stock Exchange.
‡ Unless otherwise stated all shares are fully paid. § Dividends paid in deferred share warrants, profits being used as capital.
Dividends marked § are for a year consisting of the latter part of one year and the first part of the next.

SHARE LIST OF ELECTRICAL COMPANIES.—*Continued.*

ELECTRICAL RAILWAY, MANUFACTURING, AND INDUSTRIAL COMPANIES.

Present Issue.	NAME.	Stock or Share.	Dividends for the last three years. 1897.	1898.	1899.	Closing Quotation July 11th.	Closing Quotation July 18th.	Business done week ended July 18th, 1900. Highest.	Lowest.
		‡							
65,000	Aluminium shares, Nos. 1—65,000	1	10 %	20 %	...	2¾— 3¼	2¾— 3¼	...	...
90,000	Do. 4½ % 1st Mort. Deb. Stock Red.	Stock	...	...	...	96 —101	96 —101	...	...
30,000	British Electric Traction	10	...	6 %	...	14 — 15	14 — 15	14 1/16	14 5/8
50,000	Do. do. 6 % Cum. Pref.	10	...	...	...	12 — 13	12 — 13	12 5/8	12 5/8
200,000	Do. do. 5 % Perpetual Debenture Stock ...	Stock	...	...	...	123 —126	123 —126	...	...
85,000*l*	†British Electric Works Co., Ord. £1 shares, 50,001—135,000	...	...	...	...	⅞— 1	¾— ⅞	...	...
50,000	† Do do. 6 % Cum.Pref., 1—50,000 ...	...	...	...	...	1/16— 1/8	1/16— 1/16	...	...
500	† Do. do. 4½ % 1st Mort. Deb.	100	...	...	...	99 —101	97 — 99	...	...
40,000	British Insulated Wire Ord., Nos. 1 to 40,000	5	15 %	15 %	20 %	11 — 12	11 — 12	11⅜	...
27,500	Do. do. 6 % Cum. Pref. Nos. 1 to 27,000 ...	5	...	...	...	6 — 6½	5¾— 6¼xd	...	...
90,000	Brush Elecl. Enging., Ord., 1 to 90,000	3	3 %	5 %	...	1⅝— 1⅞	1⅝— 1⅞	...	...
90,000	Do. do. Non-cum. 6 % Pref., 1 to 90,000 ...	2	6 %	6 %	...	2 — 2¼	2 — 2¼	...	...
125,000*l*	Do. do. 4½ % Perp. Deb. Stock	Stock	...	...	...	109 —114	109 —114	...	...
50,000	Do. do. 4½ % 2nd Deb. Stock Red	Stock	...	...	...	103 —105	101 —103	...	...
20,000	Callender's Cable Construction shares, Nos. 1—20,000 ...	5	12½%	15 %	15 %	13 — 14	13 — 14	...	...
20,000	Do. do. 5 % Cum. Pref.	5	...	...	...	5¼— 5⅜	5¼— 5⅜	...	...
90,000	Do. do. 4½ % 1st Mort. Deb. Stock Red ...	S ock	...	...	...	110 —114	110 —114	...	...
213,533	Central London Railway, Ord. Shares	10	...	...	...	9½— 10	9 — 9½	9⅝	9⅝
61,033	Do. do. Pref. half-shares	5	...	...	...	4¾— 5	4¼— 4⅜	4⅜	4⅜
71,447	Do. do. Def. do.	5	...	...	...	4¾— 5	4¼— 4⅜	...	...
855,000	City and South London Railway	Stock	1⅞%	2⅛%	1⅞%	64 — 66	60 — 64	65	...
37,500	Do. do. Ord. shares Nos. 22,501 to 60,000 ...	10	...	...	...	6 — 7	6 — 7	...	...
32,098	Crompton & Co., Nos. 1 to 32,098	3	...	6 %	...	3¾— 4	3⅜— 4¼	4	...
100,000	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 red	...	...	...	...	98 —101	99 —102	...	...
...99,261	Edison & Swan Utd. El. Lgt., "A" shares, £3 pd. 1 to 99,261	5	6 %	6 %	...	2 — 2½	2 — 2½	2 3/16	2
17,139	Do. do. do. "A" Shares, 01—017,139 ...	5	6 %	6 %	...	3½— 4½	3½— 4½	...	...
344,023	Do. do. do. 4 % Deb. Stock Red ...	100	...	...	...	91 — 93	91 — 93	...	...
112,100	Electric Construction, 1 to 112,100	2	6 %	6 %	6 %	2 — 2¼	2 — 2¼	...	...
25,000	Do. do. 7 % Cum. Pref., 1 to 25,000... ...	2	7 %	7 %	...	3 — 3½	3 — 3½	...	...
140,300	Do. do. 4 % Perp. 1st Mort. Deb. Stock ...	Stock	...	...	...	104 —107	103 —106	...	...
9,600*l*	Greenwood & Batley, 7 % Cum. Pref., 1 to 9,600	10	7 %	7 %	7 %	10 — 11	10 — 11 xd	...	...
30,000	Henley's (W. T.) Telegraph Works, Ord.	5	12 %	14 %	15 %	13 — 14	13 — 14	13½	13⅛
30,000	Do. do. do. 4½ % Pref.	5	7 %	7 %	...	5¼— 5⅜	5¼— 5⅜	...	...
50,000	Do. do. do. 4½ Mort. Deb. Stock...	Stock	4½%	...	...	110 —114	110 —114	...	...
50,000	India-Rubber, Gutta-Percha and Telegraph Works ...	10	10 %	10 %	...	21 — 22	21 — 22	...	...
300,000	Do. do. do. 4 % 1st Mort. Deb	100	...	...	...	100 —103	100 —103	...	...
37,500	†Liverpool Overhead Railway, Ord.	10	3¼%	3¼%	3⅜%	9 — 9⅛	9¼— 9⅜	...	...
10,000	† Do. do. Pref., £10 paid	10	5 %	5 %	5 %	13½— 13⅝	13½— 13½	...	...
37,350	Telegraph Construction and Maintenance	12	15 %	15 %	15 %	35 — 39	35 — 39	38	37
150,000	Do. 4 % Deb. Bds. Nos. 1 to 1,500 Red. 1909 ...	100	...	...	...	101 — 104	101 —104	...	...
20,000	Telegraph Manufacturing, Ord. Nos. 1 to 20,000	5	...	8 %	12 %	10½— 11½	10½— 11½	...	...
20,000	Do. do. 5 % Cm. Prf. Nos. 1 to 20,000...	5	...	...	...	5½— 6	5½— 6	...	...
540,000*l*	Waterloo and City Railway, Ord. Stock	100	...	3 %	3 %	97 —100	94 — 97	...	...

† Quotations on Liverpool Stock Exchange.

‡ Unless otherwise stated all shares are fully paid.

LATEST PROCURABLE QUOTATIONS OF SECURITIES NOT OFFICIALLY QUOTED.

*Birmingham Electric Supply, Ordinary £5 (fully paid) 8—10.
Brompton and Kensington, 4½ % Debentures of £100, 104—106.
National Electric Free Wiring, 12/6 paid. ⅜—½.
Oldham, Ashton and Hyde Electric (£10 pd.), Ord., 17½—18½.
Do. do. Pref. (£10 pd.), 10—11.

* From Birmingham Share List.

Kensington and Knightsbridge Electric Lighting, Ordinary Shares £5 (fully paid) 12—13; 1st Preference Cumulative 6 % £5 (fully paid), 7 —7⅛. Debentures, 103—104. Dividend, 1899, on Ordinary Shares 11 %.
*T. Parker, £10 (fully paid), 17½.

Bank rate of discount 3 per cent. (June 14th, 1900).

MARKET QUOTATIONS, Wednesday, July 18th.

CHEMICALS, &c.		This week.	Last week.	Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	5/-	..
a ,, Nitric	per cwt.	22/-	22/-	..
a ,, Oxalic	per cwt.	32/-	32/-	..
a ,, Sulphuric	per cwt.	5/6	5/6	..
a Ammoniac, Sal	per cwt.	39/-	39/-	..
a Ammonia, Muriate (crystal) ..	per ton	£33	£33	..
a ,, ,, ..	per ton	£30	£30	..
a Bleaching powder	per ton	£7	£7	..
a Bisulphide of Carbon	per ton	£15	£15	..
a Borax	per ton	£17	£17	..
a Bensole (90 %)	per gal.	7/-	7/-	..
a ,, (50/90%)..	per gal.	5/6	5/6	..
a Copper Sulphate	per ton	£25 10	£25 10	..
a Lead, Nitrate	per ton	£25	£25	..
a ,, White Sugar	per ton	£31	£31	..
a ,, Peroxide	per ton	£27 10	£27 10	..
a Methylated Spirit	per gal.	2/6	2/6	..
a Naphtha, Solvent (90% at 160° C).	per gal.	5/6	5/6	..
a Potash, Bichromate, in casks..	per lb.	3½d.	3½d.	..
a ,, Caustic (75/80%) ..	per ton	£24	£24	..
a ,, Bisulphate	per ton	£35	£35	..
a Shellac	per cwt.	68/-	68/-	..
a Sulphate of Magnesia	per ton	£4 10	£4 10	..
a Sulphur, Sublimed Flowers ..	per ton	£6	£6	..
a ,, Recovered	per ton	£5 10	£5 10	..
a ,, Lump	per ton	£5	£5	..
a Soda, Caustic (white 70 %) ..	per ton	£10 15	£10 15	..
a ,, Crystals	per ton	£3	£3	..
a ,, Bichromate, casks ..	per lb.	9¼d.	8¾d.	..
METALS, &c.				
Aluminium Wire, in ton lots..	per ton	£224	£224	..
b ,, Sheet, in ton lots	per ton	£191	£191	..
p Babbitt's metal ingots.. ..	per ton	£80 to £150	£80 to 150	..
c Brass (rolled metal 2" to 12") basis	per lb.	7¾d.	7¾d.	..
c ,, Tube (brazed)	per lb.	10d.	10d.	..
c ,, ,, (solid drawn) ..	per lb.	8¼d.	8¼d.	..
c ,, Wire, basis	per lb.	8½d.	8½d.	..
c Copper Tubes (brazed) ..	per lb.	11½d.	11½d.	..
c ,, ,, (solid drawn) ..	per lb.	11d.	11d.	..
g Copper Bars (best selected) ..	per ton	£83	£83	..

METALS, &c *(continued.)*		This week.	Last week.	Inc. or Dec.
g Copper Sheet	per ton	£83	£83	..
g ,, Rod	per ton	£83	£83	..
e ,, (Electrolytic) Bars ..	per ton	£81	£81	..
e ,, ,, Sheets ..	per ton	£90	£90	..
e ,, ,, Rod ..	per ton	£84	£84	..
e ,, ,, H.C. Wire	per lb.	9¼d.	9¼d.	..
f Ebonite Rod	per lb.	3/-	3/-	..
f ,, Sheet	per lb.	5 -	5/-	..
n German Silver Wire	per lb.	1/6	1/6	..
h Gutta-percha, fine	per lb.	8/- to 8/6	8/- to 8/6	..
h India-rubber, Para fine	per lb.	3/10½ to 4/0½	4/- to 4/1	dec.
i Iron, Charcoal Sheets	per ton	£18	£18	..
i ,, Pig (Cleveland warrants) ..	per ton	68/6	68/6	..
i ,, Forgings, according to size	per ton	From £11	From £11	..
i ,, Scrap, heavy	per ton	70/- to 72/6	70/- to 72/6	..
i ,, Wire, galvanised No. 8 ..	per ton	£13 5	£13 5	..
g Lead, English Ingot	per ton	£17 10 to £17 12 6	£17 10 to £17 12 6	..
g ,, ,, Sheet	per ton	£18 15	£18 15	..
m Manganin Wire No. 28	per lb.	8/-	8/-	..
g Mercury	per bot.	£9 10	£9 10	..
d Mica (in original cases), small ..	per lb.	3d. to 9d.	3d. to 9d.	..
d ,, ,, ,, medium	per lb.	1/9 to 2/9	1/9 to 2/9	..
d ,, ,, ,, large ..	per lb.	3/3 to 7/3	3/3 to 7/3	..
p Phosphor Bronze, plain castings	per lb.	1/1 to 1/4	1/1 to 1/4	..
p ,, rolled bars & rods	per lb.	1/1 to 1/4	1/1 to 1/4	..
p ,, ,, strip & sheet	per lb.	From 1/3	From 1/3	..
o Platinum	per oz.	£3 13 6	£3 13 6	..
p Silicon Bronze Wire	per lb.	10½d. to 1/1	10½d. to 1/1	..
i Steel, Magnet, acc'd'ng to desc'p'n	per ton	From £15 to £40		..
i ,, ,, in bars		£58	£58	..
g Tin, block	per ton	£146 to £147	£144 to £145	£2 inc.
g ,, foil	per lb.	1/9	1/9	..
n ,, wire, Nos. 1 to 16	per lb.	1/9	1/9	..
p White Anti-friction Metals —				
"White Ant" brand	per ton	£40 to £70	£40 to £70	..
j Yarns, Cotton, Single 10 lb b'ndl's	per lb.	8½d.	8½d.	..
j ,, Best Flax, 6 lea.	per lb.	6d.	6d.	..
j ,, Hemp, 3 ply 10 lbs. ..	per lb.	4½d.	4½d.	..
j ,, Russian, 10 lbs. ..	per lb.	5½d.	5½d.	..
j ,, Jute, 180 lbs. rove ..	per ton	£14	£14	..
k Zinc, Sh't. (Vielle Montague bnd.)	per ton	£24 5 nett.	£24 5 nett.	..

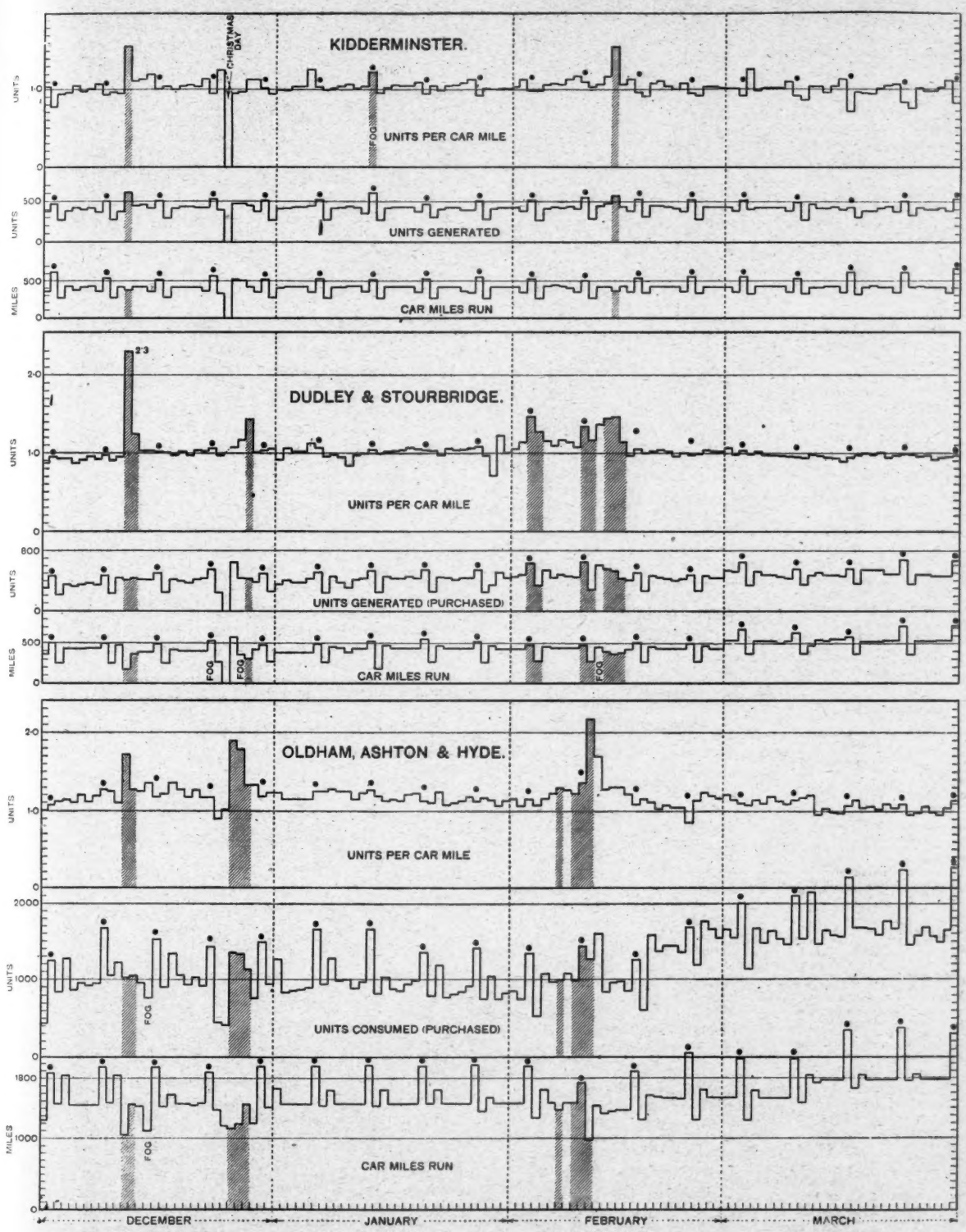
Quotations supplied by
a Messrs. G. Boor & Co.
b The British Aluminium Co., Ltd.
c Messrs. Thos. Bolton & Sons.
d Messrs. F. Wiggins & Sons.
e Messrs. Frederick Smith & Co.

Quotations supplied by
f India-Rubber, G.-P. and Teleg. Works
g Messrs. James & Shakspeare.
h Messrs. Jackson & Till.
i Messrs. Beiling & Lowe.
j Messrs. Henry C. Yeo & Co.
[Co., Ltd.

Quotations supplied by
k Messrs. Morris Ashby, Limited.
m Messrs. W. T. Glover & Co., Ltd.
n Messrs. P. Ormiston & Sons.
o Messrs. Johnson, Matthey & Co., Ltd.
p The Phosphor Bronze Company, Ltd.

POWER HOUSE DIAGRAMS.

The annexed diagrams give particulars of the running of three electrical tramways for a period of four months from December 1st, 1899, to March 31st, 1900. They are taken from the power house records, and show the total car miles run on each day during the period named: the total number of units generated for all purposes: and the ratio of the two amounts, or the units generated per car mile run, no allowance being made for the units used in the station, and only the paying car mileage being given. The smaller consumption per car mile at Kidderminster may be due to the fact that this line is chiefly one of easy gradients, and has some fairly free running along a country road-side. The period included in the diagrams contains all the snow days of the past winter, and the effect of snow is very plainly shown, the increase of the consumption per car mile being due to increased resistance to the cars themselves, and also to the snow ploughing, which is not counted as car mileage. Fog is also seen to cause an increase of the current consumption per car mile, owing probably to the necessity of ultra-cautious handling of the cars. The effect of the Saturday half-holiday is particularly marked in the Lancashire line, but it is not much accentuated in Staffordshire; not perhaps so much because Saturday is less of a holiday in Staffordshire, as that the service is so fully occupied on all days that Saturdays do not present much of a contrast, though doubtless they will do so when the number of cars available for extra Saturday traffic is increased. We are indebted to the British Electric Traction Company for this diagram.



THE EDUCATION OF MACHINISTS.

II.

In our brief abstract of Mr. Higgins's paper we brought forward chiefly the points favourable to the view he took. In the discussion

on the paper the trend of opinion on the whole was either unfavourable to the author's views, or, if favourable, was not optimistic. Rear-Admiral Melville considered that the theory was perfect. While recognising the value and necessity of the higher education of all, he pointed out that the large majority of the working classes of all nations are poor, and that an early start to work is necessitated thereby. The admiral may be right, but on this particular point it may be that there are thousands of the working classes who are in receipt of incomes of £500 to £600 per annum, and who not only do not avail themselves of any educational facilities beyond the Board School, but would be knocking at the workhouse gates if they were out of work ten days. As a class we do not believe that the workers, as they are facetiously termed, care one iota for the higher education. If they did they could well afford much more than they do.

America professes to have a working class better paid than England. If this be so, we are confident that it is not the dire necessity of poverty that causes 80 per cent. of American children to drop out of school before attaining the high-school grade. The admiral condemns the attempts to teach music, botany, physiology, other ologies and languages as time wasted that would be better spent on a useful course of grammar, commercial arithmetic, and so on. Considering the very poor elementary teaching afforded by the Board Schools of England and the common schools of America, it does seem folly to attempt the higher flights. Unless the half time school of Mr. Higgins can be State supported, he does not see how it is to be a success. Very few works care to be bothered with apprentices. Some absolutely refuse to take them, and the half time system could scarcely be attempted. Yet the half time system has proved a success in our English textile trades, where the youngsters necessary in certain light work are all half timers. He further does not believe that a commercial shop is possible. They must succeed or fail in open market, and they cannot all succeed. That fact will condemn the system. He, therefore, thinks the State ought to provide school shops properly equipped. It appears to us that the members of the American Society of Mechanical Engineers have thought only for their own special sect. If trade schools are to be thus established for one trade, they will be demanded equally for all trades. One good outcome of a general system would perhaps be that the more careless and unworthy would drop into the lower ranks of labourers, whereas now it often seems to us that the labourer is a vastly superior man to the fitter or other so-called mechanic he has to serve.

The manual training school is not approved, for it is too superficial in the training it affords. Finally, the Admiral believes in the system of apprenticeship, but he does not say what is to be done in a land where they refuse to take apprentices. As Europe also is objecting to apprentices, there will soon be no trained tradesmen left; America cannot then draw her supply of skilled workers from Europe, and in common with Europe will perhaps come round once more to the old system or something very like it.

Prof. Hatton's contribution to the discussion resolved itself into an argument about consulting engineers, and he attributed the advance made in America to its freedom from the consulting engineer of the Old World type. But he did not go on to show that America, while freed from what has certainly become an evil with us, has not lived up to the freedom from restraint, but has become almost as much a slave to the shop manager, and is rapidly sacrificing quality to ease of manufacture. Americans generally forget that much of their business here is not effected because of better articles being supplied by them, but because English firms have been too busy to quote, and we note an American tendency—having secured customers—to supply much less for their money under the same nominal rating than what they offered when first trying to secure a customer.

Prof. Thurston endeavours to differentiate the education of machinists, foremen, and mechanical engineers. A trade school properly organised should be narrow in its teaching. It should teach single vocations as masonry, carpentry, or the trade of machinist. It does not involve work in pure science with a view to its application to engineering, nor a knowledge of the methods of the physical or chemical laboratories. He rightly points out that there is room for millions of narrowly trained men where hundreds only of trained engineers can find a place. Now this is sound sense. He thinks there can hardly be an over supply of properly trained men. He would, therefore, provide trade schools for the thousands; already there are ample schools of engineering for the hundreds. He would keep the entrance standards high, but he insists on a thorough differentiation between the trade schools and the engineering schools, which actually involve more severe training and higher attainments, scientific and general, than either law or medicine has been accustomed to demand.

From the many who have joined in the discussion, one broad fact appears, that the machinist is almost wholly in the minds of all. The skilled trades appear out of sight or out of mind, and the machinist stands forth pre-eminent, showing how very much the Americans do depend on machine work, and explaining to some extent the reason of their shortcomings. In England it is true that machine work has not taken the high position it has in America. A good tradesman stands higher than a machinist, who used often to be, and still is, a glorified labourer—an unskilled workman, that is to say, taken off the shop floor, to use the conventional term.

Prof. Kimball distinctly states that he does not believe that the manual skill required to-day is as high as it was 30 years ago. No doubt this is true. The machine does the work, and machines are made and worked by men of little manual skill, though no doubt particularly apt in gauging the capacity of their machines, and by their aid doing good work.

Prof. Morris does not believe that four years can turn out a man of the class Mr. Higgins requires, while a shop foreman says nothing can take the place of the real apprenticeship system. Prof. Thurston concludes with an appeal for some kind of return to the system, whereby an apprenticeship in a regular shop could be carried out at the same time as a more or less academic training. He also believes in the instruction shop at a school in preference to the construction or commercial shop, for, as he says, quite a lot may be done, and the student made a fairly good workman by systematic instruction, whereas in a construction shop making things purposely to sell he must first become skilled.

The question naturally arises: Is it wise to teach more than principles and familiarity with tools and methods? Can any kind of work, in fact, be taught, any more than legal practice can be taught at school or college?

The beauty of the instruction shop is that all sorts of things can be made, not merely the narrow lines of goods whereby alone a shop can possibly be made to pay. The making of goods to sell spells monotony, and all interest would go out of the work of students which now attaches to each fresh piece of work—it may be a pump or an engine, or a piece of laboratory apparatus.

Many of the arguments were coloured with the idea that the recent American success was due to superior quality. This is not strictly the truth. There has been cheapness, due to system in manufacture, but the success has been due to facts of a commercial kind fully as much as to engineering, and to engineering only in the narrow, though important sense of the efficiency of machine work. So it comes that much American stuff is better made than designed, better tooled than cast, better filled up along ragged castings than it is smooth cast, and better turned along flat edges than round the corners of such edges whereby alone a good finish is made. American methods are very strictly utilitarian, it is true, and a well finished corner may be useless, but on the same grounds, the putty filling of a casting would be better omitted.

Prof. Sweet was favourable to Mr. Higgins's ideas, but would by no means treat all pupils alike, and he would rather keep the teaching of the individual in narrow lines. Those of ability he would put through many avenues; the less capable through fewer. A would-be machinist he would make to give most of his time to that branch with some time to drawing, to pattern making, and to the foundry, while the draughtsman would give some time to patterns, foundry and machine work, and so on.

If we were to put our own conclusions broadly, we would say that all should be taught on comparatively narrow lines to earn their living by being able to do something well, but that further education must spring from themselves. The means to a much better education on broad lines are already freely available in many non-utilised directions, but take one line only, that of the free library—do we not all know that the trashy novel forms 75 to 80 per cent. of the business done? The facilities are already ahead of the desire to use them. It appears to us that the machinist trade has provided openings in America for a special and somewhat peculiar class of men, who have found themselves able to earn thereby better wages than at other occupations, and, untrammelled by any union rules, have sent up production to something like the rate it would go at here if work were allowed to go on freely. But if it is only the machinist class for which the trade schools are needed so much, it would appear unnecessary to go to so much elaboration to secure an end that is so soon attained in well organised shops with labourers taken off the floor.

It seems to us certain that few men would remain as repetition workers on machine tools if they could get anything better, or unless they felt themselves to be so much better than their fellows that they foresaw a move upwards. As a class they cannot, of course, all get the move up.

THE WORK OF THE LIGHT RAILWAY COMMISSION.*

By R. H. SCOTTER, C.E., M.I.Mech.E.

(Member of the Association.)

When the history of the Light Railway Movement in this country comes to be written, two points will come out very prominently, both illustrating the deeply seated need which existed and which called forth legislation on the matter. 1. The non-political, or, rather, dual political, character of the agitation, both in and out of Parliament. 2. The rapidity with which the facilities offered by the Act were seized and taken advantage of all over the country. Both these are very encouraging factors in the work we, both individually and as an association, have undertaken to perform.

The progress of the movement has been especially encouraging to those who have tried for so many years to convince the people of this country that cheap and ready transit from producer to consumer is an absolute necessity if we are to maintain our position in the world's commerce. The fact that both political parties are con-

* Paper read at the Tramways and Light Railways Association at the Agricultural Hall on Wednesday, June 27th.

vinced of this, assures us a steady run in the future, unhampered by General Elections, or a chance vote, snatched at a moment of political or municipal excitement.

It is with these facts before me that I venture to call the attention of the members of the Tramways and Light Railways Association to the work which the Light Railway Commission has accomplished, and to attempt to call attention to some of the good points and some of the weak points of the Light Railways Act, 1896.

I consider this a most opportune moment to bring the matter forward, because the Act itself expires next year, and I feel that this Association can hardly render a better service to the public and the tramways and light railway industry generally than by discussing freely the working of the Act, and before Parliament undertakes its revision, by submitting to the proper quarters some practical suggestions for its improvement.

With the formation of the Light Railway Commission, the distinct advance in procedure introduced by the Commissioners, and the popularity which has attended its work and results, we are all more or less familiar.

The bold attempt at decentralisation introduced by the Act, by which duties hitherto performed by the House of Commons were delegated to the Board of Trade and Light Railway Commission, caused many old Parliamentary heads to shake with ominous distrust. But after watching the movement very carefully, I, for one, must unhesitatingly state my opinion, that the step which has been made in this direction is an unqualified success.

At the local inquiry, much more real information is forthcoming than in the House of Commons Committee Room; and this, together with the unvarying kindly patience and courtesy extended to all by the Commissioners, has done much to interest public bodies and the public generally in light railways and tramways. This, in its turn, has influenced the large development in the movement, as it is useless for engineers to spend time and thought and money in framing schemes to meet local needs if the public are not also interested.

The success of the movement is evidenced by the large number of applications made, and the length of mileage asked for the promoters under the Act, 1896.

When it is stated that between December, 1896, and May 31st, 1900, 3½ years, proposals, plans, and estimates have been received by the Commission for a mileage of 2,800 miles, a length greater than the total mileage of Irish railways, equal to the L. & N.W., and L. & S.W. combined, and greater than our longest railway, G.W.R., and more than double the total mileage constructed in 30 years under the Tramways Act, the magnitude of the *need* becomes apparent. Nor is the *need* confined to one part of the country or to one class of district.

Places as far distant and as dissimilar as Penzance, Wick, and Inverness, Colwyn Bay, Bedgelert, and Southend-on-Sea, have benefitted by the Act, as well as the most thickly populated manufacturing centres in the North and Midlands of England, and in the metropolitan area.

During the years 1897-8-9 and 1900, the Commissioners have held 208 local inquiries into the merits of 247 schemes, the general result being that 55 per cent. were granted, 24 per cent. rejected, 14 per cent. withdrawn, 7 per cent. to be dealt with.

At the present time the account stands thus:—258 applications received for permission to construct 2,657¼ miles, and capital estimated at £17,889,000. Add to this 24 applications lodged May 31st for about 240 miles, and the total capital may be placed between 18 and 19 millions sterling.

How have these orders been dealt with?

Of the 258 received to end of 1899, 138 have been granted, 65 rejected, 36 withdrawn, 19 not dealt with or deferred.

So that the Commissioners start next month with an arrear of only about 7 per cent. to pull up; and then they have 34 schemes presented last month to take in hand. So far for the local inquiry.

When the Light Railway Commissioners have satisfied themselves that a scheme is a good one, we should think the Board of Trade, the Commissioners, promoters, solicitors, and all concerned, would hurry matters forward, so that the line might come into existence as soon as possible. But such is not recent experience.

Of the 138 fortunate schemes approved to date by the Light Railway Commissioners, 108, representing 112 schemes, have been sent to the Board of Trade for confirmation. Of this number 77 have been confirmed, leaving 61 approved schemes at the present time awaiting confirmation.

It will therefore be seen that very often considerable time elapses between the verdict given by the Commissioners in favour of the scheme and the actual issue of the order. The average time between the deposit of the plans and the issue of the order is 16 months, or nearly double the time required for the obtaining of similar powers per Act of Parliament or provisional order. Of this period not more than six months elapses between deposit and local inquiry; hence, on an average, 10 months are occupied in the process of "settling the order."

Here, then, appears to be one weak spot in the constitution of the Light Railway Commission. More help is required, in order that the order, when once approved, may be rapidly settled. This point has been brought out very forcibly by the Commissioners in their reports.

They say "That the time lost in travelling from place to place is very considerable, and the ever-increasing number of applications will make it impossible to deal with them in the proper time unless some fresh arrangements are made."

I would suggest that the attention of Parliament might be directed by this Association to this point. That an increase of the number of Commissioners might be suggested with a view of curtailing the time allowed between approval and confirmation, and also to granting some additional powers by which the Commissioners might "spur on" both promoters, objectors, and their solicitors to prompt action within a given time. At present valuable concessions are often hung about by frivolous objectors, who take advantage of this flaw in the Act, and impose upon the courtesy of the Commissioners, in order to obtain some real or fancied advantage. While they are thus hanging matters over, public interest flags, the scheme is somewhat discredited, and the chances of local financial support are minimised by the dog-in-the-manger policy adopted by objectors. If a "time limit" were imposed, no injustice would be done to either side, and many frivolous objectors would be brought to their senses.

At present, Parliamentary procedure is "limited" by the length of the Session; a Bill must be passed or thrown out during that period.

Under light railway precedure, much of the money saved by simplification is lost, either directly or indirectly, by the scheme "hanging fire" after it has been approved by the Commissioners.

Two other facts have been noticed with the development of the light railway movement in this country, and I venture to think we who are so closely connected with the industry cannot afford to overlook them. In the early days of the movement, the existing railway companies gave no encouragement to the light railway movement, wherever they could they opposed, taking refuge in that bogie "competition."

We contend that a light railway, properly designed, cannot *compete* with an existing line, because the true function of a light railway is to continue into hitherto unremunerative districts the facilities offered by the railway. The light line can live where the "heavy" one would starve because it has a smaller carcase to keep up.

Railway companies, however, held aloof from the movement, no doubt because their managers very little understood that light railways would bring grist to their mill at little or no expense to themselves. When, however, it dawned upon them that the movement was one come to stay, they very 'cutely stood aside, nodding approval while other people found the money, and *now* their attitude is wholly different.

Scarcely a railway in the country, I believe, maintains its former attitude. Several are promoting light railways themselves and others are on the watch to get their hands on the purchase clause. Herein a word of caution is necessary.

We must not give away our birthright for a mess of pottage; 25, 30, or 42 years is short enough time for repayment of capital in an enterprise which is absolutely new, and which depends for its existence on crumbs which have been cast from the rich man's table. In other words, light railways and tramways tap districts hitherto untapped by railway companies because they would not "pay." They will rely largely upon *creating* new traffic.

When it has been created and nursed, it will not be fair that our quasi-benevolent neighbours, the railway companies, should *then* swoop down and take all the profit. It is a point which must be taken into account and kept in mind when railway managers smile approval upon the promoters of a light railway.

Mention of the purchase clause, too, reminds me of the altered attitude of local authorities and the County Councils in particular. I believe in many parts of the country, the local authorities, having their hands on the pulse of the people, are more keenly alive than any other class of the community to the importance of light railways and tramways. Their support has been loyally and heartily given to many good schemes. But here again a word of caution is necessary, so that too much may not be given away by promoters.

Some County Councils—I do not refer to the London County Council—are making efforts to obtain a clause in each Light Railway Order promoted within their area, that at the expiration of 25 or 30 or 35 years, they shall have the power to purchase the undertaking if the local authorities fail to do so.

Now this introduces a new element. We all know that the chances are very much against the *whole* of the local authorities agreeing to purchase. But when the County Council comes along with its respectability, its weight of influence, its massed debt, and its ability to borrow money, the chances of the light railway company having short notice to quit are enormously increased.

I am quite aware this card has two faces, but that it must be considered as a new element in the game I think all will concede, and it must receive most careful attention when the Act comes on for revision in 1901.

Cannot this new Bill be made to settle once for all the supposed difference between a light railway and a tramway? Cannot we insist upon the Tramway Act, 1870, being revised at the same time? I believe it will be possible to effect such a change, if we show ourselves desperately in earnest about the matter.

It will be noted that the Light Railway Commissioners themselves divide all applications into two classes:—(*a*) Light railways resembling ordinary railways; (*b*) lines which may be shortly described as road or street railways.

By approving over 250 miles of the latter class, they have set their approval on the use of the ordinary roads of the country for the carriage of both passengers and goods traffic. I believe this practice to be a good one, and that it opens up an enormous field for electric traction, as steam locomotion is by no means suitable for this purpose.

In many cases the roads have to be widened before the lines can be laid. I think this a wise and fair regulation, but I consider that provision should be made in the revised Act to prevent promoters of light railways being mulcted when carrying out what is undoubtedly a public improvement. Wider roads are for the benefit of all the users of those roads. Hence, when a railway or tramway company finds it cannot buy land for that purpose except at an abnormal rate, legislation should step in. Undoubtedly one great

improvement which the Act will allow to be carried out, will be a solution of the housing problem. It can only be solved by allowing the worker to live away from congested town centres. To do this, local authorities have tried and failed. If light railways and tramways accomplish this end, they should certainly feel that the local authorities will help them over the purchase question.

In revising the Tramways Act, our policy must be to get rid of Clause 43. Parliament has gone half way by allowing promoters of light railways a longer time than 21 years in which to recoup themselves. Here, again, tramways and light railways should be put on the same footing.

But let us have Clause 43 abolished from the Statute Book for ever. No clause has been so detrimental to the progress of electric traction. I presume, however, its funeral will be attended by our legal friends in full force. But no one else will be there!

On the question of financing light railway and tramway undertakings, I will content myself with mentioning the fact that, although Parliament some four years ago sanctioned the spending of £1,000,000 by way of loans at 3½ per cent. for the purpose of helping the development of light railways the concession is so hedged in by "provided thats," that so far only half a dozen grants have been promised.

I think that the future of the movement depends very largely upon the support private enterprise can give it, and in this direction I would point out that, although investors have not given great attention to light railways, they will certainly become paying concerns in the near future. The Board of Trade and the Light Railway Commissioners exercise such a rigid control over the financial side of the matter, that over-capitalisation is practically impossible. This should go far to induce local capital to be invested in an enterprise which depends for its success upon local opinion and local support, and is specially concerned with the development of the country through which it passes.

In conclusion, I trust the Association will strengthen the hands of the Parliamentary Committee by sending in full and practical information upon the working of the Light Railways Act, and endeavour, by discussion, by meetings, by agitation, to formulate and transmit to the proper authorities such practical amendments of both Acts, that we may obtain a Light Railways and Tramways Act which may enable us to make up for lost time, and bring electric and other systems of traction in this country up to their proper level.

I feel the Association, by pursuing this policy, will confer a benefit, not only on the industry, but upon the whole community.

THE MUNICIPAL ELECTRICAL ASSOCIATION, 1900.

IMPRESSIONS OF AMERICAN TRAMWAY PRACTICE.

By A. E. Le Rossignol, Corporation Tramways Engineer, Newcastle-upon-Tyne.

The conditions governing tramway practice in America are essentially different from those prevailing in this country; on that side of the Atlantic the tramway concessions are almost without exception in the hands of companies, who, in very many cases, have been granted them in perpetuity, and, in some cases, at merely nominal rents, so that now the value of these concessions is very great. In addition, the process for obtaining leave to extend is very much simpler and quicker. There are practically no limitations set by law to any combinations or absorptions the companies may choose to make with other companies, and the speed of running is very great.

Contrast these with the conditions prevailing on this side of the water; in Great Britain concessions for tramway construction take a long time to carry through and are difficult to obtain. Combinations or absorptions are jealously watched and difficult to bring about, and companies and corporations are very much hampered therefore in developing their tramway systems to anything like the scale which American tramway undertakings attain, if successful, while the maximum speed allowed is so low that competition with railways is out of the question.

Again, owing to the inherent conservatism and venerable age of British institutions, the delimitations of local authorities are very much more circumscribed and divided up than in America, so that extensions which involve trenching on the ground under the control of different and distinct local authorities, involve much more difficulty in obtaining leave for extension, both to companies and to municipal authorities who may wish to extend a tramway system owned by them.

Need we wonder, then, at the great extent reached by some of the tramway systems in America—systems formed by the gradual acquisition by one master company of all the competing lines in any one city or district, till at last all the lines are under one control, and competition is entirely done away with. As you may have noticed, a typical instance of this spirit of absorption has just been completed in New York. Prior to this year there were two tramway companies in New York—the Metropolitan, which had gradually absorbed all the smaller companies, with the exception of one, and the Third Avenue Company, which owned two lines running from the heart of the city out to the Haarlem River, and, beyond that, owned a large extent of country lines. Early this year the Third Avenue Company got into financial difficulties over the provision of new capital to meet the heavy expenditure it incurred in converting the cable system into an underground conduit system, and the Metropolitan Company stepped into the breach, provided the capital required, and thus obtained control of the last opposition company left in New York.

Latterly the American tramway world has become greatly exercised over the question of municipal ownership. The municipalities, who originally granted free wayleaves, and, in some cases, ground rights on the streets as well, to the tramway companies, in order to get them to run lines out into the country and create new populated districts, now find that these rights and privileges granted by them are becoming very valuable, and are seeking either to get hold of the tramways again, or else to make the companies reduce the fares or pay higher percentages of their receipts to the municipal authorities. The companies are, therefore, deprecating in the press municipal ownership, and as an argument in their favour, compare the extent of the largest tramway system in a town in the States of a similar size, greatly to the advantage of the latter, of course. In their comparisons, however, such reasons as I have given in the first part of this paper are entirely overlooked, but there is no doubt that municipal ownership in the United States under the conditions prevalent at present in municipal circles on that side, would give rise to a great deal of bribery and corruption, until in course of time a better moral condition of municipal life comes to the front.

At the time the combination took place between the Metropolitan Traction Company and the Third Avenue Company in New York, the former had very nearly finished a very large power station, from which they were already supplying the lines they had converted to electric traction, and the Third Avenue Company were only laying the foundations of a still larger power station, so that the amalgamation has in this case come at a suitable time when the question of the provision of the requisite amount of power for the combined system will not be complicated by the existence of too many power stations. In most previous amalgamations of this kind in the States, of which Philadelphia is a typical example, the combined company has left on its hands a multitude of small power stations, each of which have been owned by one or other of the smaller companies it has absorbed.

Due to the fact that conversion to electric traction was just in progress, the combined company in New York is now in a very favourable position to extend its large system in the best and most economical way, and the present tendency, one might almost say the fashion, in tramway construction in America, leans towards the erection of a large central station with high pressure distribution to sub-stations. Those companies which are hampered with a number of low tension power stations do not, however, admit that their economical results are very greatly inferior, if at all, to those attained as yet by the larger single systems, and are in many cases providing for additional extensions by adopting battery sub-stations with charging mains to those fed by boosters. By the almost universal adoption of coal handling and storing machinery, too, the fuel costs of stations in America are kept remarkably low; as they are all owned by private companies, however, a strict reticence as to these costs is maintained, in complete contrast to the practice on this side of the water, where we are accustomed to publish full details of all working costs.

As economy in current generation is greatly influenced by the expenditure on labour in the station, central station practice in America rightly tends to the introduction of very large steam power units, but these are all of the open slow moving type, and so require a larger amount of attendance than would the same size units, if enclosed and provided with automatic lubrication, such as have been largely adopted in this country.

A system of mechanical oil supply to these large open engines has been adopted, but if the enclosed type were made as strong in proportion and as reliable in operation as the large open type, there is no doubt that increased economy in labour would be obtained, and doubtless English manufacturers will awaken to this fact in a short time.

Due to the heavy strains encountered in direct current traction work, American steam units have gradually grown to huge proportions of the strain-bearing part, the shaft, and even though the strains probable in alternate current work will be very much less, the same proportioned engines are being installed in the three-phase plants.

Owing to the adoption of large steam units, the question of provision of adequate boiler power in a reasonable amount of floor space to correspond with the engine floor space has been met by the adoption of two or more boiler floors one above the other, surmounted by huge coal bunkers at the top, and exemplify the trust placed by American engineers in steel-framed buildings.

The question of control of the large amount of electric power generated by the large units is now being taken into adequate consideration; up to the present switchboards have always been strongly suggestive of the instrument-making days, but in the new power station of the Metropolitan Traction Company the switches are built on engineering lines of generous proportions, and are worked by pneumatic power and controlled electrically. Three large galleries at one end of the engine house are given up entirely to the switches, each in a brick cell of its own, while the actual controlling boards take up very little space.

Underground open conduits seem to work very successfully, but have only been introduced in two cities, New York and Washington, in both of which towns no sanction for overhead wires could be obtained, and the companies had to face the heavy costs of underground conduit construction.

In both towns the companies were greatly assisted in the expense by having to convert a large extent of cable traction into underground conduit, a change that is and has been carried out without much interruption of the service. Two conductors are always used, and means provided for changing these conductors on to either positive or negative bars, so as to enable traffic to be kept running, even with one conductor grounded in any or every section.

Transformers are mostly of the air blast cooled type, and have the low tension side directly connected, without switches, to their rotaries. These latter apparently work very well, and do not give any trouble with overloading, providing no over-compounding is attempted. Compounding for a level voltage is provided for by the introduction of self-induction in the high tension feeders and a series winding on the direct current of the rotary. Return current automatic cut-outs on the high tension feeders have been installed at sub-stations, but up to the present do not seem to be very reliable in their working.

In no case, so far as I am aware, are return current boosters used, the current having always to find its way back to the station by the rails and supplementary cables, so that even with good bonding the maximum fall of voltage from one end of a line to the station is sometimes very great. There is no limit fixed by law, and the only limit the companies recognise is an economic one when too much pressure is lost in the return circuit. A good deal of electric welding and cast welding of the rail joints has been done, and the last is looked upon, I think, with more favour; no bonds are used with this method of jointing, but if used in this country, with the Board of Trade limiting the total fall of potential to 7 volts, bonds would certainly have to be provided.

Overhead work in America does not compare at all with what is put up in this country, either as to strength or neatness, but in many other traction matters we have something to learn from our American cousins, especially from the way they have realised the great part electric traction plays in making adequate provision for the population of large cities; enabling poor people to live at a greater distance from their work and in better surroundings, than is otherwise the case.

In conclusion, I would like to express my thanks for the kind hospitality dealt out to me by all the engineers I met during my visit.

THE INCANDESCENT LAMP.

By ED. C. De SEGUNDO, Assoc.M.Inst.C.E.

It has been said that a thousand inventions are involved in the present form of incandescent lamp, which, unfortunately, is still far from perfect. How many more inventions may be necessary to render the incandescent lamp a highly efficient transformer of energy, it is impossible to say, but there can be no doubt that in this direction lies a field for profitable research in effecting further economies in the cost of electric light.

Let us for one moment examine the way in which energy is dissipated in an electric incandescent lamp. A rough approximation to the absolute efficiency of the electric lamp may be arrived at from the researches of Prof. Tyndall, as follows: According to this authority, one cubic foot of London gas, burned in a flat flame burner, should yield 947 candle-hours, and as the average calorific value of a cubic foot of London gas may be taken to be about 630 thermal units, the light equivalent of one thermal unit would be, roughly, 1·5 candle-hours on this basis. It is, of course, evident that it may be considerably more, but it cannot be less, and as long as it is clearly understood that 1·5 candle-hours per thermal unit is not a measure of the absolute light equivalent of heat, but the relative value based upon the chemical combustion of coal gas with oxygen, we shall not be misled.

Having then arrived at 1·5 candle-hours as a figure which ought to be realised by the expenditure of one thermal unit, the candle-hours which should be produced by 60 watt-hours work out to

$$\frac{42{\cdot}42 \times 1{\cdot}5 \times 60 \times 60}{746} = 307{\cdot}2,$$

and the efficiency of the 60-watt 16-c.p. lamp becomes $\frac{16 \times 100}{307{\cdot}2} = 5{\cdot}2$ per cent. There should therefore be ample scope for improvement in this direction.

Small as is this efficiency, it is a considerable improvement upon the results yielded by incandescent lamps in the early days, and it may be said, without risk of contradiction, that the enormous expansion of the electric lighting industry is mainly due to the improvements effected in incandescent lamps. Electric light has been brought within the limits of practical illumination, and so great has been the extension of domestic electric lighting, and so great has the demand for electric lamps become, that all sorts and conditions of lamps have been placed upon the market, some good and some bad, but most of them hopelessly inconsistent as to ratio of watts consumed to candle-power emitted.

We can all remember when the 100-volt lamp was looked upon as an interesting experiment, and the 50-volt lamp was the only one that yielded satisfactory results at anything like 4 to 5 watts per candle. Since those days the untiring energy and skill of workers in this field have produced a 100-volt lamp that is as efficient, and indeed more so, than the 50-volt lamp of yore. To-day we are experimenting with the 200-volt lamp, and although no one is as yet prepared to stand sponsor to it, yet there is no doubt in anyone's mind that eventually such difficulties as lie in the way of turning out a good 200-volt lamp will be overcome, and then, possibly, higher voltages may be attempted. A day will probably come when it will become expedient either to increase the voltage of supply or to put down fresh mains, and of the two evils, a supply company will naturally prefer to select the lesser.

Much has of late been written and said concerning the economies of the so-called high efficiency lamp, but, in general, the word efficiency is misapplied in this connection. If a 4-watt lamp made to burn with a life of 1,000 hours at 50 volts be inserted in a 60-volt circuit, it is clear that the candle-power emitted per watt will be much higher than that at which it is rated, viz., 0·25, but no one would dream of calling it a high efficiency lamp simply because it was connected to a circuit in which the potential difference maintained was greater than that at which the lamp was normally intended to work, and yet the ordinary high efficiency lamp is practically the equivalent of the arrangement above described. The correct description of a high efficiency lamp is one which will yield the same candle-power throughout the same life as other lamps which consume more power per candle emitted at any epoch throughout their lives. In this matter of economy in power per candle emitted history repeats itself at the present day; a 2½-watt per candle lamp can be obtained which is as good as the 3-watt lamp of some years ago, and possibly in time the 2½-watt lamp may be as efficient and as satisfactory as the 3-watt lamp is at the present day.

In the *Journal of the Franklin Institute* an interesting paper by Mr. Francis W. Willcox has recently been published which deals very lucidly and fully with the development of the incandescent lamp industry in America, and draws attention to several interesting and important features which have stimulated progress in lamp manufacture. Mr. Willcox rightly asserts that the important operations involved in the production of an incandescent lamp are four in number; and that beside these, the other processes may be considered to be comparatively simple. These four operations are (1) making the filament; (2) treating or flashing the filament; (3) joining the filament to the conductor connections; (4) exhausting the lamp.

The writer recently had the privilege of examining the processes adopted by Mr. Robertson at the General Electric Company's factory at Hammersmith, and it is interesting to note that a similar process to the one in use at Hammersmith is described by Mr. Willcox as that under which filaments are manufactured in America, namely, by chemical deposition. The filament, which is practically moulded, is allowed to coil upon itself in a certain solution until a considerable length is obtained, after which it goes through the processes of drying and baking. The filament so produced is exactly uniform in section, a characteristic which in olden days it was almost impossible to obtain in the old bamboo filament, and which was only approximated after a waste of some 90 per cent. of the material, whereas upon the chemical principle just referred to over 95 per cent. of the material is utilised.

Primarily "flashing" was resorted to for the purpose of rendering the filament more uniform in section; the filament was burned at high incandescence in the presence of gasoline vapour which, being decomposed, deposited a coating of graphitic carbon over the surface of the filament. This was a very distinct improvement in lamp manufacture, and although, owing to the fact that a filament of uniform section can now be produced, the reason for the "flashing" process no longer exists, "flashing" is still resorted to because the graphitic carbon which is deposited in the process is more durable than the carbon of which the filament is composed,

and also because the emissivity of the filament is thereby decreased.

Great progress has been made in the method of joining the filament with the connections in the head of the lamp, the modern type of paste and deposited joint being a big advance in simplicity and cheapness, but perhaps the greatest advance has been made in the methods of exhaustion. Formerly lamps were exhausted 50 and 100 at a time, with the inevitable result that it was impossible to give the attention to each lamp necessary to secure the best results. Further, even with the most perfect type of pump, it was impossible to produce a sufficient degree of exhaustion. Now a gas is introduced capable of combining with the gases left in the bulb, with the result that these gases are rendered inert and the insulation of the filament is more perfect. The time required for exhaustion is now about one minute, as against four to five hours in the early days.

In spite of the improvements which have been introduced, it is not possible to ensure each lamp being of the voltage designed. Apparently the old axiom that like causes produce like effects does not apply to incandescent lamp manufacture, and not more than one-third of the lamps made can be relied upon to be of the correct voltage, which means that to supply an order for 1,000 lamps the manufacturer must calculate upon having to turn out 3,000 to 4,000 lamps from which the 1,000 have to be selected. This process of selection is one, however, which in this country at least leaves much to be desired. Judging by experience of 200-volt lamps, it would appear that no selection whatever had been exercised. This, of course, may be due to the immense demand, but it is certainly a matter which should engage the very serious consideration of the manufacturer.

Mr. Willcox is of opinion that a 3½-watt 200-volt lamp is practicable. He says: "A number of such lamps have been made and sent abroad and used in special installations in this country where they have given good results. The conditions are not ripe, as yet, however, for the marketing of such a lamp. The average 200-volt station has not very close regulation."

With these remarks most of us will agree.

The stimulus to produce a lamp of reliable voltage, candle-power and efficiency, is probably greater in America than in this country under existing conditions. In England the charge for current is, in nearly every instance, made by meter, whereas in America the charge is by contract, based upon the number of lamps installed. In these circumstances it is easily seen that while in England no one suffers any very material damage, owing to variations in the wattage, the consumer in America will very soon complain if the change from 100 volts to 200 volts by the supply company compels him to buy a lamp which has not so long a life as the one he has been accustomed to; so that in order to avoid bringing discredit upon electric lighting, it is very necessary that any change, such as from 100 to 200 volts, or from 4-watt to 3½-watt lamps should not give the consumer cause for complaint. This has led American manufacturers to work for a good maintenance of candle-power rather than a very high candle-power at the start, and a more or less rapid diminution in intensity after the first few days.

(*To be continued.*)

ON THE PHOTOMETRY OF ARC LAMPS.

By F. W. CARTER, M.A., Cantab.

(*Continued from page* 45.)

The mirror, M, should be a good, flat one; for the results may be far wrong if it converges or diverges the light. It should be oblong, the length being $\sqrt{2}$ times the breadth, so that it appears square as seen from the photometer. It may be 2 feet × 2 feet 10 inches, or even larger, according to the largest size of the globe and reflector of the lamps used. It should be substantially mounted and be capable of turning about an axis in the line of the photometer's path, which makes an angle of 45° with its normal. The centre of the mirror, the photometer, and the standard must be in a straight line, about 5 feet from the ground.

The screen, B, is, of course, opaque, and has in it a circular hole of 2 feet diameter, concentric with the axis of the mirror. The bench should reach nearly to this screen, for though this end is not used in making the measurements with the lamp, it will be wanted in calibrating the standard, S.

If the standard and arc are always to be kept the same distance apart, the bench may be divided so as to read the ratio of the squares of the distances of the arc and standard, as is commonly the case in gas testing sets; but it is not only more accurate to use an evenly divided bench,

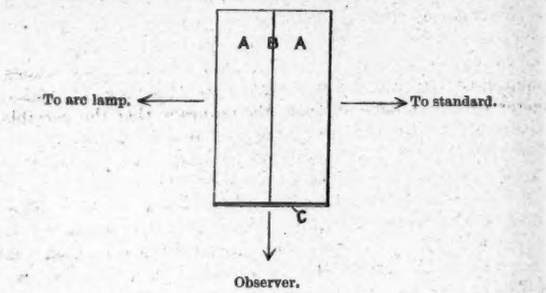


Fig. 3.

but also, of course, more flexible, whilst the calculations can be made extremely easy, as will be shown hereafter. A bench divided, let us say, in inches and tenths, can be conveniently used for testing glow lamps or any other lights as well as arcs.

The standard, S, is a secondary one, and may be any gas or glow lamp of 50 or more candle-power. Its chief requisite is constancy. The actual source should not be too large, as the measurements are mostly made with the photometer near the standard. If a glow lamp is used, one with a compact filament is preferable to one with a large U filament. If the source has extension along the bench, the effective radiant point is usually somewhat nearer to the photometer than the centre of the source; for instance, if an Argand burner be used, its radiant centre is about one-fifth of the diameter of the flame nearer to the photometer than the centre of the burner. If the source only extends at right angles to the bench, the correction for size is of less importance, depending on the square of the linear dimensions.

In addition to the standard, S, a primary standard will be required. A Harcourt 10-C.P. pentane standard is suitable for this purpose, though any other reliable standard of about this power may be used. To calibrate the standard, S, we put our primary standard in the position which the arc has when arranged for the measurement of its horizontal intensity, and using the reflected light from the primary standard, find the apparent candle-power of the secondary standard, S. If we use this apparent candle-power in our measurement of the arc, we shall correct for the absorption of the mirror and for any difference between the two sides of the photometer. The method is exactly analogous to that of weighing by substitution.

I have already mentioned the impossibility of comparing lights of different colours, on account of their being unable to produce results which are equal for all purposes. It thus becomes necessary for us to fix upon some criterion of comparison for use in our measurements. Let us, then, say that we will consider the illuminations due to two lights to be equal when we can distinguish black print on white paper equally well by either. On this principle is based the "distinctness" photometer to be described below, in which a meshwork of black lines seen on a white ground is substituted for the print on white paper. The essential feature of the photometer is an addition which might be made to one of any form in which a comparison is made between the illuminations of two areas, one of which is illuminated wholly by the arc lamp and the other wholly by the standard lamp, *i.e.*, practically any ordinary kind of photometer except the Bunsen grease spot form. I will describe it as applied to the Joly form of photometer.

It is shown, about full size, in plan in fig. 3, and in front elevation in fig. 4. A, A are equal blocks of paraffin wax or of milk glass, separated from one another by a thin plate of metal foil, B. This constitutes the ordinary Joly photometer.

One block is illuminated by the arc, and the other by the standard, and the effect is viewed from the front, c. To this front I attach a plate marked with a graduated mesh or other convenient pattern, as shown in the elevation, fig. 4. To use the photometer, we seek the level at which the mesh becomes so fine as to begin to be indistinct, and move the photometer until this level is the same on the two sides of the centre line. It is not advisable to peer too closely at the mesh in order to see the finest squares, but better to run the eye rapidly from the coarse squares at the top of the diagram downwards until the first impression of indistinctness is obtained, and to set the photometer from that. This not only saves the eyes, but is quicker and gives results at least as accurate as can be obtained by judging from the very smallest squares that can be seen. As would be expected, a certain amount of practice is required before one can set the photometer quickly. The results that this form of photometer will give have at least the accuracy that the variable nature of the arc will permit us to aspire to in this subject. They far excel in definiteness any obtained by attempting to directly compare the illuminations, and depend much less on the judgment of the observer. The following table gives some results, taken at random from amongst many others, which will serve to show what degree of accuracy can be expected by the use of this apparatus. In it, however, the differences in the readings at the same angle are quite as likely to be due to variations in the arc as to errors in photometry—more likely, in fact, in the case of such readings as those taken partially in the shadow of the negative carbon. The readings are in inches, measured from the arc, the standard (a Dibden's gas standard of 50 nominal c.p.) being, at reading, 360.

The arc was a 9-ampere open one kept 3 mm. long by a hand feed arrangement.

Angle, measured from vertical.	Readings.	Mean reading.	Candle-power.
90°	210·4 208·9 205·9 207·7	208·2	171
80°	211·4 211·5 211·4 210·1	211·1	182
70°	246·4 251·2 250·4 253·1	250·3	475
60°	261·5 264·9 260·8 259·0	261·6	640
50°	271·2 270·2 267·5 270·8	269·9	814
40°	274·8 276·0 276·4 277·8	276·3	995
30°	281·5 282·8 285·1 288·4 285·2	284·6	1,300
20°	272·6 274·4 275·5 275·9 277·9	275·3	961
10°	146·0 148·7 146·8 126·0	141·9	38

One might expect the eyes of different persons to differ in relative sensitiveness for various colours, which might cause them to disagree in setting the photometer; but although one of this form has been in use at the Central Technical College for nearly two years, during which time some scores of students have used it, some of them with the particular view of settling this point, I have never been able to detect any trace of such an effect.

When the photometer takes this simple form, it is an advantage to cover the head of the observer with a hood, so as to cut off extraneous light, and to arrange partitions

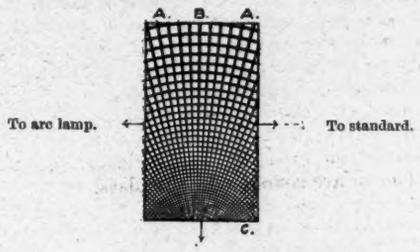


Fig. 4.

in the box so that he can see nothing but the mesh diagram. The photometer box should run on wheels or be otherwise arranged to move easily along the bench. A small mirror, mounted on an arm, and capable of adjustment at any angle, may, with advantage, be attached to the box, in order to illuminate the scale by reflection from the standard.

(*To be continued.*)

MUNICIPALITIES AND ELECTRIC TRAMWAYS.

While in no wise attempting to anticipate the conclusions of the Parliamentary Committee which has been for some time assiduously collecting evidence that has any bearing on the various phases of municipal trading, there are incidents cropping up from time to time which merit some passing notice. Mr. John Raworth, some days ago, pointed out in one of our financial contemporaries the important social benefits which electric tramways would confer upon the public, but he was inclined to think that municipalites were not always likely to facilitate progress, not from any lack of enterprise, but rather from the fact that a municipality was handicapped by its parochial constitution and predilections.

It is obvious to the most casual observer that the great utility of electric tramways lies in the rapid and efficient communication which they can establish between town and suburbs, and in many cases between town and town. Unless the network of tramways were complete, it would lamentably fail in one of its most prominent attributes. The question then arises as to which is the best agency for providing a complete system of tramway communication. It is apparent that most municipalities consider they are the best authorities to deal with local tramways. Yet there are few cases where they have provided or proposed a scheme which has for its object the connecting up of a town or city with its tributary towns and villages. Glasgow tried hard to carry out some such system, but judging from results, it will only partially succeed. Liverpool is establishing a very large and complete system of electric traction, but it is not in harmony with outside local authorities, and for that very reason the tramways may become restricted in their scope. There are some who argue that municipalites should confine the tramways to their own towns, and if any connecting up with other towns is required, it should be done by private enterprise. Such a course might commend itself to the advocate of municipalism, but private companies are not often disposed to pick up the crumbs that fall from anybody's table, and we do not think they are likely to aid municipal undertakings very largely in this manner.

There appears in the current issue of our contemporary, the *Tramway and Railway World*, a series of striking interviews with leading municipalists on the prospects of electric traction, and as the views expressed bear materially on the

attitude of Corporations towards electric tramway undertakings, it will be useful to consider some of the opinions expressed.

It is clear that the aims and ambitions of the London County Council lie in the direction of possessing a complete system of electric tramways over the entire metropolis. Not only do they seek to revivify the existing tramways, but they propose to introduce tramways into streets and thoroughfares which we thought to be as far from electric traction as is the North Pole; in other words, if the London County Council has its own way in the matter, we may expect to find electric cars following the line of 'buses from Liverpool Street to Piccadilly. It is a bold policy which Mr. Benn, the chairman of the Highways Committee has sketched, but there are many causes operating against a uniformity of tramways in London; for instance, as Mr. Benn points out, "it is possible for some of the companies whose systems are important, to hold out for a considerable period, and thus prevent that uniformity of action which is essential to the development and the perfecting of a unified tramway system in London." But the most serious obstacle, according to the same authority, arises from the antagonism existing between local authorities in London and the County Council. There are 50 authorities in the area over which the County Council desire to operate electric tramways, and as these small local authorities own the roads, they possess a power of veto, and they are apparently determined to use their prerogative to the fullest extent. We are not surprised, for the London County Council has rarely lost an opportunity of harassing the local authorities, and it is not very remarkable if the London vestries attempt to hit back. Some weeks ago we noted the harsh and unnecessary treatment which was meted out by the London County Council to the Islington Vestry, and it could scarcely be expected that the latter body would be, under the circumstances, inclined to further any proposals of the Council. Consequently, the London County Council is likely to be in a peculiar and difficult position, for, on the one side, it is not likely to meet with much consideration at the hands of the subsidiary authorities of the metropolis, and Parliament is not likely to grant any enlargement of the Council's sphere of influence. No doubt, from a public point of view, it would be very desirable to have a unified system of tramways, and probably the profits from such a large scheme might be available for many local purposes; but, rightly or wrongly, the public is not always convinced of the disinterestedness of the Council's schemes, certainly there are many who would hesitate to accept the tramways proposals with the necessary faith which is essential to the success of so large an undertaking. Apart from the peculiar causes that may tend to defeat the objects of the central authority of London, one could fairly doubt the ability of any large parochial authority to command the sympathy and co-operation of smaller local bodies. The history of joint municipal schemes is mainly one of failure; sewage and water schemes which have been proposed to meet the requirements of more than one local authority have frequently resulted in interminable disputes, and many an admirable proposal has been abandoned for this want of union among local authorities. It is not always easy to account for this absence of co-operation among such bodies. They are all believers ostensibly in the principle of municipal government, but they are not anxious to become partners. At the same time, it is desirable that some agreement should be arrived at among Corporations whose lines are likely to lie near each other. The Liverpool Corporation, for instance, is, as we have said, carrying out an extensive system of tramways, but, according to Mr. C. R. Bellamy, the general manager, they are hemmed in, not because of any physical or geographical conditions, but simply owing to the fact that outside authorities have got powers for tramways which surround them. No doubt the question of joint running powers will be eventually discussed by these various authorities, but such matters ought to be raised when the schemes are projected, otherwise there may be important differences in gauge of track and other details, which would put running powers quite out of the question.

An instance of that has already arisen in the case of Leeds and Bradford, in both of which towns municipally-operated tramways are at work. Eventually these systems will be brought together, but the Leeds cars will never be able to pass over the Bradford lines on account of the differences in gauge; this at once destroys one of the great advantages that ought to accrue from electric tramways adjoining each other.

We are not anxious to persuade our readers that electric tramways will be badly carried out because they happen to be in the hands of municipalities, but we are merely suggesting some of the difficulties that lie in the way of extensions beyond municipal areas. The principle which underlies municipal ownership and that of private enterprise are so absolutely different that we will not attempt to discuss them, at the same time it must not be forgotten that some of the most important schemes in the country could not have been carried out except by companies. The extensive system of electric tramways at Middlesbrough and Stockton could hardly have been brought to a successful issue if it had remained in the hands of the municipalities, for the lines run through districts which are controlled by several local authorities, and we doubt very much whether the different local interests would not have prevented a municipal scheme. Similar experience has been obtained in other parts of the country, all of which goes to show that large tramway schemes in many parts of the country are quite impracticable without private enterprise.

Notwithstanding the difficulties that exist in the way of municipal tramways, many of the schemes that have been suggested by the corporations and authorities of large towns are extremely important.

In London there are at the present moment 115 miles of tramways, and though compared with Glasgow and many other large towns, the mileage is lamentably out of proportion to the population, it will be no mean achievement to transform these for electrical working. But the Council has Bills before Parliament for extensions which will bring the mileage up to 250 miles. According to Mr. Benn, if the whole of the present lines were converted for electrical working, the present profit of a quarter of a million would be turned into a profit of £660,000, and if the extensions projected were carried out that sum would be increased to at least 1½ millions of net profit. That sum represents to the rates, supposing it were devoted to the relief of them, 10d. in the £. The figures are very alluring, but sufficient details are not given to permit us to offer any criticism.

The chairman of the Highways Committee makes an important announcement as to the system which it is proposed to use, and from the interview we learn that the Council is determined to adopt for thickly populated districts an underground system which in all probability will be a conduit. One could not, of course, take seriously the technical reasons advanced by the chairman in favour of underground conduits if they were his own, but as they may have been derived from an expert it is just as well to refer to them. It is suggested that the conditions with regard to the two Government observatories, make it necessary that perfect insulation should be secured, and this cannot be obtained by either the overhead wire or the surface contact. No one would deny the inalienable right of the Government observatories to be protected against stray currents, but is it seriously contended by the County Council that an underground conduit will provide this protection? It is not more than a few days ago that the Westinghouse Company showed at the Agricultural Hall exhibition a method of actually preventing the leakage of current from conduits, which is sufficient evidence that leakage will occasionally arise in these systems. We are not by this admitting that a sectionising of a conduit is a desirable thing, but we seek to emphasise the point that no form of conduit will altogether prevent stray currents from escaping from it. If the County Council were really concerned for the National Observatories, why not adopt a double trolley, which would be infinitely cheaper and less likely to cause leakage than a conduit? Besides, the County Council is not entirely wedded to a conduit, for it proposes to use the overhead wire in districts which it considers suitable, and where the road authority has no objection. Considering the enormous expenditure which the Council will incur in the construction of a conduit, we should have looked for some more adequate reasons than those we have indicated. If the overhead wire system is acceptable to the authorities of Hammersmith and Chiswick, why should it be distasteful to the authorities of Lambeth and

Kennington? Moreover, the construction of the overhead lines at Kew is quite in accordance with the authorities at Kew Observatory, and the County Council is never likely to have tramways as near as those of the London United Tramways.

If Mr. Benn is really speaking on behalf of the County Council, then we consider the position adopted is an untenable one. Probably one ought to feel thankful that the County Council is convinced that electricity is a necessary part of a tramway service, but we shall nevertheless continue to condemn its conduit policy until some more adequate reasons are advanced. It is quite useless to quote New York and Paris as instances of municipal opposition to the overhead wire; if the municipalities of these cities had been carrying out the work themselves, they would not have hesitated to use overhead wires. The Corporation of Birmingham for a long time would not permit a company to erect overhead wires, but we are glad to see that there is a complete reversal of this attitude.

There is ample evidence to show that municipalties are taking up electric traction with enthusiasm, and certainly the results which have been obtained amply justify the policy of extensions. Liverpool is already provided with 150 cars which are operating along 30 miles of track. In the year before the Corporation took up the tramways, 38 millions of passengers were carried on the cars, but under the municipal management the number in 1899 had increased to 60 millions. It is expected that with new rolling stock the passengers carried will have increased this year to 100 millions.

From Manchester, Leeds and Sheffield comes the same story of improvements which have been wrought by electricity, and one of the most satisfactory features is that instead of depreciating property as was once so much feared by the opponents of electric tramways, quite remarkable developments of residential areas have taken place.

The development of suburban districts no doubt largely depends on low fares, and in this respect the municipalities are certainly not neglecting their duty to the ratepayers. It may be argued that as only a section of the public use the tramways it is a little unfair to give all the advantages to the passenger, but the answer to this is that the electric tramcar ought to become a popular and universal vehicle. Bad as the London omnibus is, it is used by the highest and the lowliest, and neither peer nor commoner despises an outside seat. The electric car with its greater cleanliness, its higher speed and its marked efficiency will, no doubt, have a greater vogue. The question of fares is being fully discussed by all authorities who own or are about to operate tramways, and to what extent electricity will influence them is apparent in the remark of Mr. Benn, who considers that a universal penny fare with halfpenny stages is within range of practical administration, "but only under electric service and unified conditions for the whole county." At Liverpool the manager of the tramways says: "we bring the bulk of the people down in the morning, take them home again for dinner, back to business again in the afternoon, and home again at night. That more than doubles the traffic. It is an object lesson as to the advantages of electric traction, and the benefits it brings in its train." The experience with the electric tramways at Leeds has led the municipality to make considerable reductions in fares. A penny is charged for the first two miles in any direction, and a penny a mile beyond. The introduction of halfpenny fares has not been apparently attended with any degree of success; indeed, on a horse section of tramways it has resulted in loss, but as the experiment is to be repeated on one of the electric sections, it will be interesting to see what the result is. It should be observed that halfpenny fares in Glasgow have been a signal success, but probably the local conditions have been responsible for this; certainly, in a town having a dense population halfpenny fares would be more likely to succeed than in a district where the population was scattered.

The experience gained in America conclusively showed that the introduction of electric tramways in a given district was immediately followed by building operations. Arguing from this it would appear that electricity might have a material influence on the housing question which is at the present moment deeply concerning the various local authorities. It is held with a certain degree of reason that electric tramways will provide a means of preventing the terrible overcrowding which is occurring in most towns. Certainly, if facilities are given to the average working man, he would prefer to live in the suburbs to herding in a town slum. But though much has been said on the subject, there has been very little action in the direction of properly housing the poor. The Nottingham Corporation is, however, likely to consider the question of electric tramways and housing together; in fact, Sir Samuel Johnson, the town clerk of Nottingham, considers that these two modern practical problems ought to be joined together. To quote his words:—"The two must go hand in hand, and then, I think, it will be found that in a few years an immense improvement will be effected in the condition of the working classes." One of the new sections of electric tramways in Nottingham will proceed from the centre of the town, and extend into an undeveloped district, where the Corporation owns considerable tracts of building land. It is expected that a scheme will be propounded for the development of this land for the housing of the working classes. The town clerk says:—"It is hoped that the houses will be made additionally attractive to the working classes by means of a considerable plot of garden being attached to each, and the residential charms will be considerably enhanced by some arrangement whereby the tenants of each house may have one free pass for our tramways." This is certainly taking up the housing question thoroughly, and it will be interesting to watch the experiment both socially and electrically.

NEW PATENTS AND ABSTRACTS OF PUBLISHED SPECIFICATIONS.

NEW PATENTS, 1900.

Compiled expressly for this journal by W. P. Thompson & Co. Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool, Manchester and Birmingham, to whom all inquiries should be addressed.

11,897. "Improvements in trolleys for overhead electrically driven tramcars." J. T. Pearson. Dated July 2nd.

11,907. "An improved block or mounting for electrical gas and like fittings." J. Bolton. Dated July 2nd.

11,914. "Improvements in the manufacture of electrodes for secondary batteries." J. C. Richardson. Dated July 2nd.

11,915. "Improvements in and in connection with trolleys for overhead cable railways or tramways." G. R. Tomb. Dated July 2nd. (Complete.)

11,939. "Improvements in or relating to production of type by means of electric current." F. C. F. Knaak and J. S. Campbell. Dated July 2nd.

11,933. "Improvements relating to the regulation of electric motors." R. Lundell. Dated July 2nd. (Complete.)

11,937. "Improvements in telephone systems." F. B. Stafsing and C. Egner. Dated July 2nd.

11,941. "Improvements in electric motors and regulating appliances for turret turning gun training and analogous purposes." W. H. Scott. Dated July 2nd.

11,944. "Switching arrangement for Nernst and vacuum incandescence lamps." V. F. Feeny. (Allgemeine Electricitäts Gesellschaft, Germany.) Dated July 2nd. (Complete.)

11,965. "Improvements in electric receivers and electric clocks." A. Barr, W. Stroud, and L. Becker. Dated July 3rd.

11,970. "Improvements in or relating to the construction of electric switches and contact makers used for electric tramways and the like." J. Milnes. Dated July 3rd.

11,991. "Improvements in rheostats for electric motors." The British Thomson-Houston Company, Limited. (J. L. Hall, United States.) Dated July 3rd. (Complete.)

11,997. "An improvement in accumulators or secondary batteries." R. Rodrian. Dated July 3rd.

12,001. "Improvement for providing an automatic lock for the purpose of securing electric and other lamps in lampholders, electric and other shades in holders, and locking couplings of a like nature." E. P. Barfield. Dated July 3rd.

12,003. "Improvements relating to dynamo-electric mine exploders or apparatus for firing explosives." J. Wetter. (L. C. Gomant, France.) Dated July 3rd. (Complete.)

12,016. "Improvements relating to electrically propelled motor vehicles," T. J. Ryan. Dated July 3rd. (Complete.)

12,018. "Improvements relating to electric propulsion for motor vehicles." T. J. Ryan. Dated July 3rd. (Complete.)

12,054. "The electric lighting of motor-driven vehicles." P. H. Frost-Smith. Dated July 4th.

12,055. "A device for extending the control of certain automatic switches." E. Price. Dated July 4th.

12,074. "An improvement in static voltmeters." Siemens Bros & Co., Limited. (Siemens & Halske Aktien Gesellschaft, Germany.) Dated July 4th.

12,086. "Improvements in electrical storage or secondary batteries." A. W. Baxter and C. Baxter. Dated July 4th.

12,089. "Improvements in dynamo-electric machinery." C. E. Grove. Dated July 4th.

12,100. "Improvements in or relating to electrical tramways and the like." E. B. Viles. Dated July 4th.

12,111. "Improvements in electrical jacquards and dobbies." J. Szczepanik and L. Kleinberg.

12,115. "Improvements in apparatus for magnetically separating iron or steel borings, filings, and the like from brass or other non-magnetic substances." B. Young. Dated July 5th.

12,128. "A device for shielding fallen wires from overhead electrical conductors." G. S. HOLMES. Dated July 5th.

12,152. "Improved method for the practical application of lead secondary batteries." C. HEIM. Dated July 5th. (Complete.)

12,160. "Improvements in the manufacture of filaments for electric incandescence lamps." V. THOMAS. Dated July 5th.

12,170. "Electric meter." P. MANDOWSKY. Dated July 5th. (Complete)

12,175. "Improvements in electrical relays." THE THOMSON-DAVIS TELEPHONE SYSTEM, LIMITED, and A. T. M. THOMSON. Dated July 5th.

12,177. "Improvements in the holders of electrical incandescent or glow lamps." W. WALKER, jun. Dated July 5th.

12,179. "Improvements in or connected with electrical tramways or railways." H. HIRST. Dated July 5th.

12,256. "Improvements in and relating to electric arc lamps." C. A. M. BARNER. Dated July 6th. (Complete.)

12,267. "Improvements in electric accumulator." V. DE ROBINSKY. Dated July 6th.

12,276. "Improvements in hooks or clips for gas and water pipes, electric wire conduits, picture rods, and the like." COPE, ALLMAN & CO., LIMITED, and W. ALLMAN. Dated July 7th.

12,296. "Improved turbine fan or air propeller driven electrically or by mechanical power." B. RUSSELL. Dated July 7th.

12,308. "Improvements in or connected with water-tight switch cases." E. L. PINCHING and W. H. WALTON. Dated July 7th.

12,315. "Improvements relating to electrical signalling and communicating apparatus." G. BLANCK, J. W. HUDSON, and W. J. DOWNS. Dated July 7th.

12,321. "An improved collector for electrical machines and like." F. KAEFERLE. Dated July 7th. (Complete.)

12,331. "Improvements in blocks for electric conduits." E. SCHELLBACH. Dated July 7th.

12,338. "Improvements in dynamometers and/or brakes." J. H. S. H. MAWDSLEY. Dated July 7th.

ABSTRACTS OF PUBLISHED SPECIFICATIONS.

Copies of any of these Specifications may be obtained of Messrs. W. P. THOMPSON and Co., 322, High Holborn, W.C., and at Liverpool, Manchester, and Birmingham, price, post free, 9d. (in stamps).

1898.

17,517. "Improvement in telegraph apparatus." Maiche, Limited. (L. Maiche.) Dated August 13th, 1898. Relates to receiving relays and transmitting apparatus especially for long-distance signalling. The pivoted coil is arranged in a magnetic field, and is connected to a line. A second low resistance coil is wound on the same spool, and is so connected up with the battery that on completion of the relay circuit under the action of the first coil the second coil restores the relay to its normal position. A platinum rod connected to the spool is arranged to make contact with a vertical surface of mercury in an open glass tube. In the transmitting apparatus an induction coil has its primary connected in a local circuit with the key and battery, the point between battery and primary being earthed. The secondary coil is connected to line and earth through the primary. 5 claims.

17,522. "Improvements in means for transmitting motion from electric motors to other machinery." W. Geipel. Dated August 13th, 1898. Relates to belt-gearing for transmitting motion from electro-motors to other machines. A counter shaft, supported in a slide adjustable along a pivoted arm, carries two pulleys, one coupled to a pulley on the shaft of the motor, and the other to a pulley on the driven shaft. The arm is adjustable by a screwed rod or a notched quadrant, or both. 2 claims.

17,539. "Improvements in the manufacture of filaments for incandescent electric lamps." S. Imray. (Dr. C. A. von Welsbach.) Dated August 15th, 1898. Relates to incandescent lamps. Osmium filaments, such as are described in Specifications Nos. 1,535 and 13,116, 1898, are now prepared from mixtures containing oxides which can be volatilised out of the filaments at a white heat, and which carry out impurities not removable by mere heating of filaments containing them. The mixture preferred consists of 10 parts of osmium with four parts of titanium oxide, by weight, both very finely divided; but alumina, magnesia, or lime may be used. Organic binding material is added. The filaments are squirted from a die, and if not quite smooth are rolled between glass plates covered with smooth paper; they are then formed, dried, and gradually heated in a reducing atmosphere until the oxide volatilises. Uniform dense elastic filaments are thus produced. 3 claims.

17,583. "Improvements in electric batteries." O. T. Bugg, jun., and D. H. Darling. Dated August 15th, 1899. The battery consists of a cell of lead which also forms part of one of the electrodes, the remainder of which is constituted by the perforated lead cylinder and the pieces of flaky lead which are packed between the two parts. The cell is closed by a rubber cover having a central dome in which fit loosely a number of thin rectangular sheets of zinc which constitute the other electrode. The lower ends of the zinc sheets rest in a central depression in a sheet of glass having an upstanding cylindrical part in which collect any pieces which fall off the zinc electrode. The electrolyte used is dilute sulphuric acid, and the battery when polarised is regenerated by the passage of an electric current through it. 6 claims.

17,591. "Improvements in arc lamps." H. H. Lake. (Compagnie de L'Industrie Electrique.) Dated August 15th, 1898. Arc lamps. Brake-regulating-mechanism for use with continuous or alternating current. The carbon holders are hung by cords from opposite sides of pulleys on a shaft the upper holder being heavier. A large pulley on the same shaft is surrounded by a cord attached at its ends to a spring and to a pulley on a second shaft, which carries a shuttle or other armature in the field of an electro-magnet. The armature has no commutator, its rotation being limited. The extension of the spring is limited by a stop, and the rotation of the second shaft by an arm and stop. The magnet is differentially wound, the coil on one limb being connected in parallel with the carbons, and that on the other in series. The armature may be in series or parallel; or it may consist of a bar without a winding. Current passes through the carbons tends to turn the armature in opposition to the spring, and to separate the carbons, separation may occur at any time if deposited carbon shortens the arc. 1 claim.

17,592. "Improvements in portable electric lamps." O. T. Bugg, jun., and D. H. Darling. Dated August 15th, 1898. A lamp support applicable to a bicycle or other vehicle is made with a ring carrying a reflector, a screw-capped lamp, and a metal casing, which is provided with an insulating lining and screw covers, and contains one or more galvanic cells with conductive cases. The central contact of the lamp is in contact with a metal strip, which is insulated and placed between the casing and its lining, or in a recess in the lining; the upper end of the strip may be pressed into contact with the inner electrode of the upper cell by a screw. The upper cell rests on the inner electrode of the lower one, and the lower cell is connected by the casing and ring with the screw cap of the lamp. 5 claims.

17,597. "Improved vacuum drying apparatus for drying bobbins, armatures, and the like of dynamo machines or motors." E. Passburg. Dated August 13th, 1899. Relates to vacuum drying apparatus for bobbins, armatures, and the like of dynamo machines or motors, covered wires, and electric cables. The armatures &c., are dried in a chamber closed at one end by a cover, and at the other or both ends by doors adapted to be held closed by bolts and supported by travellers running on rails; or the doors may be carried by a frame hinged to the chamber. The apparatus is heated by tubes, a steam mantel, heating plates, or hot air, gases, &c., outside the cylinder. The vapours escape through a tube to a condenser or vacuum pump. The armatures, &c., are run into the apparatus on wagons. 2 claims.

17,601. "Improvements in electric arc lamps." C. Oliver. Dated August 15th, 1898. In a regulating mechanism having a clutch controlled by a rocking frame which carries the weighted cores of series and shunt solenoids, the series core is supported so that it can rise independently of the rocking frame, and it thus acts only by relieving the frame of its weight. The object is to prevent "pumping" when the arc is struck, and sudden lengthening of the arc at any time by increased current. The lamps are specially applicable in short series circuits. In the construction described, the series core slides in a sleeve pivoted on the rocking frame and is supported by a spring thereon. The upper end of the core loosely fits the solenoid bobbin, which serves as a dash-pot. The frame is fulcrumed at its middle. The shunt core is pivoted directly to the rocking frame, and carries a dash-pot on a stationary piston. The clutch of ordinary construction, acts on the heavier upper carbon carrier which is connected by a flexible connection over a pulley with a sliding rod carrying the lower carbon. The invention is illustrated in the specification as applied to a lamp having two pairs of carbons controlled by two clutches on one rocking frame. In modified arrangements, the series core may be connected by a slot and pin to the rocking frame; or a dash-pot and piston may be interposed between the series core and the rocking frame. 4 claims.

17,626. "Improvements in cord grips for electric lampholders." A. Watson. Dated August 16th, 1898. Relates to holders for incandescent lamps. A cord grip consists of an earthenware or other insulating block provided with two oppositely inclined holes and with cone-shaped recesses through which the conductors are drawn, the holes being out of line with the corresponding connecting blocks. Between the recesses the insulated block is made with a transverse groove to receive a partition formed on the insulating body. The parts are connected by the casing and a screw ring. In another arrangement, the conductors are clamped in grooves between a cone and a conical sleeve, which are pressed together by a screw ring on the casing. 3 claims.

17,647. "Improvements in or relating to electrical switches, plugs and the like." F. G. Baily. Dated August 16th, 1898. Relates to the connection of a switch with a wall socket or the like, so that the plug can only be inserted or removed when the switch is "off." A plate having a key-hole slot and sliding in a groove in the socket is connected by an arm with the switch handle. The plug can only be inserted in the socket when the circular portion of the slot registers with the opening in the socket. The plug is grooved and is thus locked in position when the switch is "on." The switch also cannot be moved until the plug is fully home. In order to close the mouth of the socket when the plug is removed, a plug slides on the central contact and is forced upwards by a spring. It is grooved so that it can be locked by the plate. In a modified form the socket is constructed for a plug having two pins, and the plate has openings which, when the switch is in the "off" position, register with the contacts of the sockets. The pins have notches for locking them in position, and the plate may have a yielding connection with the switch handle. 5 claims.

17,659. "Improvements in and relating to electric meters." H. H. Lake. (E. Bergmann.) Dated August 16th, 1898. Relates to energy meters. A counting mechanism is arranged to register difference in the movements of two clocks, the escapements of which are controlled by oscillating arms carrying pressure coils, near stationary current coils; the arms are also acted on by springs, and the coils are connected so that their effect is to assist one spring and oppose the other. Small oscillations only are allowed. To synchronise the clocks when no current is passing in the coils, two coils may carry iron extensions which move near one another, so that they tend to oscillate together. Or the axes of the arms may be connected by a light spiral spring. Or the arms which are retarded when current is flowing in the main coils may be accelerated when no current is flowing, by a spring on them then coming in contact with a finger carried by a balanced lever, a pawl and ratchet being provided to prevent backward motion of the counting mechanism. The balanced lever carries a core in the current coil, and is drawn down out of contact with the spring, when current is passing. Instead of the springs, the coils may move near a stationary permanent magnet, or one of the current coils may be replaced by a stationary controlling coil. In modified arrangements, the coils move directly to and from the current coils, instead of parallel thereto. 5 claims.

17,692. "A system of reflector for double globe electric arc lamps." O. von Mulmann. Dated August 16th, 1898. A double-globe electric arc lamp is provided with a reflector constructed in one or more pieces, and arranged in the interior of the exterior globe under the cap thereof, and supported by the support of the lower carbon-holder. In another form, a reflecting enamel is applied to the interior surface of the globe. 1 claim.

17,705. "Improvements in the method of and means for electrically extracting poisons from the human body." J. B. Campbell. Dated August 17th, 1898. The appliance comprises a suitable battery, the negative electrodes of which are formed by a body resembling the poison to be extracted, and are applied to the feet or to the affected part, the positive electrode being applied to the neck. The poison is stated to be collected in the negative electrode. The appliance is also stated to cure all diseases by extracting the poison which produces them. 1 claim.

17,741. "Improvements in electric batteries." T. Machin and E. Cake. Dated August 17th, 1898. The positive plate consists of a folded strip of copper, while the negative plates consist of independent plates of zinc placed between the folds of the positive plates and connected by tangs to a connecting strip. The plates are kept apart by strips of vulcanite and rest on strips of wood laid on the bottom of the cell. The positive plates are held in position either by fitting exactly into the corners of the box or cell or by plates of glass fitted into grooves in upper and lower cross-pieces and bearing against the end faces of the copper plate. 2 claims.

17,764. "Improvements in or connected with electric meters." H. Reason and The Mutual Electric Trust, Limited. Dated August 17th, 1898. Relates to quantity meters. A motor-meter is provided with a very short and thick field magnet, consisting of cylindrical pole-pieces surrounded by coils carrying the current to be measured and a shunt current, and attached to large square plates, the magnetic circuit being completed through an adjustable iron screw and the air. The armature may be of any kind, such as a large disc immersed in mercury, as described in Specification No. 17,026, A.D. 1898. The armature and mercury bath may be conical, holes being provided in the upper part of the armature for the passage of air. 8 claims.

17,780. "Improvements in or relating to electric storage batteries and in switches for use therewith." J. T. Niblett and M. Sutherland. Dated August 18th, 1898. The electrodes are made of a coil wound around a core, the coil being of such a shape in cross-section as to aid in keeping the active material in place. Either the core or the coil may be made of non-conducting material. The electrodes, except the end ones in a battery, are coupled together in pairs by a single wire, the negative electrodes being preferably shorter than the positive electrodes. In the same cell the electrodes are separated by diaphragms. Each cell consists of a glass vessel contained in a wooden casing, and a number of such casings may be glued together. Each cell is preferably closed by a perforated plug. To facilitate the charging of the battery from mains supplying current at a voltage corresponding to or less than full voltage of the battery, the cells are connected together to form two battery sections, and two of the terminals which are respectively connected to the positive pole of the battery section, and to the negative pole of the battery section are provided with adjustable contact-arms which may be moved into the position shown, to connect the battery sections in parallel, or by turning the arms through 180°, they meet on the contact-stud, and the battery sections are then connected in series. A similar arrangement of contact-arms is provided, when there are more than two battery sections, so that all of the sections may be connected in parallel for charging or discharging, or one section may be used alone, or two or more sections may be joined in series for discharging. 4 claims.

17,817. "Improved apparatus for signalling deficient flow of water and increase of temperature in liquids flowing through tubes and the like." C. P. Kirsten. Dated August 18th, 1898. Relates to the application of a temperature alarm to indicate quickly the interruption of flow of liquids in cooling apparatus. In one form of the apparatus, a thermometer is placed in an annex communicating with the tube, through which the cooling water flows. When the flow is interrupted the temperature of the water rises, and acting on the thermometer, sends the mercury up the tube till it closes an electric bell circuit. 2 claims.